ATER and RELATED LAND RESOURCES
UMBOLDT RIVER BASIN
NEVADA

REPORT NUMBER EIGHT

REESE RIVER SUB-BASIN

JUNE 1964

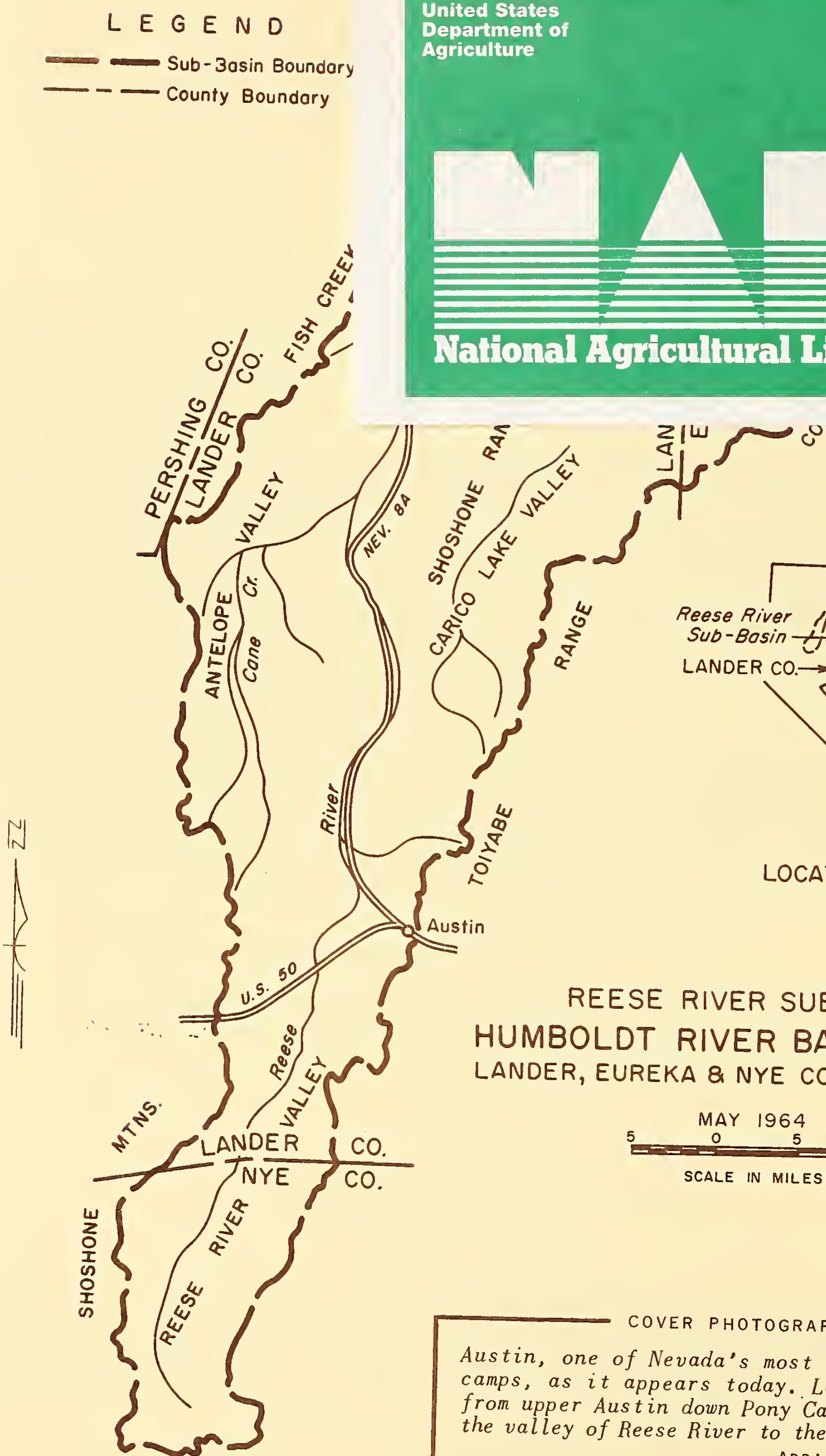
Based on a Cooperative Survey

by

THE NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
and THE UNITED STATES DEPARTMENT OF AGRICULTURE

Prepared by

Economic Research Service · Forest Service · Soil Conservation Service



LOCATION MAP

REESE RIVER SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
LANDER, EUREKA & NYE COUNTIES, NEVADA

MAY 1964

5 0 5 10
SCALE IN MILES

COVER PHOTOGRAPH

Austin, one of Nevada's most historic mining camps, as it appears today. Looking westward from upper Austin down Pony Canyon and across the valley of Reese River to the Shoshone Range.

ADRIAN ATWATER PHOTO

USDA SCS PORTLAND OREG 1964 M-4146

REGISTER

REPORT NUMBER EIGHT
REESE RIVER SUB-BASIN
June 1964

Will you please detach and fill out this form; mail it to us, so that we may send you any additions, changes, or corrections.

Humboldt River Basin Field Party
P. O. Box 982
Elko, Nevada 89801

Name ______________________________

Address ______________________________

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WATER AND RELATED LAND RESOURCES

REPORT NUMBER EIGHT

HUMBOLDT RIVER BASIN

NEVADA

REESE RIVER SUB-BASIN

Based on a Cooperative Survey
by
The Nevada Department of Conservation and Natural Resources
and
The United States Department of Agriculture

Forest Service - Soil Conservation Service
Economic Research Service

June 1964

FOREWORD

This is a report for the people of Nevada, and particularly for the people of the Humboldt River Basin, concerning water and related land resources in the Reese River Sub-Basin. It is the eighth of a series of reports resulting from a cooperative survey of the Humboldt River Basin by the Nevada State Department of Conservation and Natural Resources and the U.S. Department of Agriculture. It was prepared by the Soil Conservation Service, Forest Service and the Economic Research Service of the Department of Agriculture.

The State of Nevada seeks constantly to assist local people and their organizations in the conservation, development and management of water resources. It has particular regard for the relationship of water to land and to human resources. This is exemplified by the creation of the Nevada State Department of Conservation and Natural Resources. A primary responsibility of that Department is to cooperate with Federal agencies and local groups and to coordinate State-Federal activities that help solve water and related land problems for the people of Nevada.

The responsibilities of the Nevada State Department of Conservation and Natural Resources, and the cooperative research work already under way in the Humboldt River, set the stage for Federal-State cooperation in developing information on opportunities for improving the use of the land and water resources of the Basin. Accordingly, cooperation was initiated with the U.S. Department of Agriculture under a Plan of Work dated June 3, 1960 with agencies of the Department and of the State of Nevada participating in the survey. It is important here to point out that responsibility for matters concerning State water rights and determination of water supply as it might affect State water rights was assumed by the State of Nevada.

This cooperative survey of the Humboldt River Basin is for the primary purpose of determining where improvements in the use of water and related land resources, some of which have social and economic aspects, might be made with the assistance of projects and programs of the U.S. Department of Agriculture. A major part of the survey is focused on situations where improvement might be brought about by means of Federal-State-local cooperative projects developed under the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress as amended). This survey is in keeping with long-established tradition in the Department of Agriculture of cooperation with States and local entities in the conduct of its work. Further, such cooperation is a most important responsibility of the Nevada State Department of Conservation and Natural Resources.

The U.S. Department of Agriculture-State of Nevada Plan of Work in the Humboldt River Basin offers opportunities for participating in the survey by other Nevada State agencies and Federal agencies. The Bureau of Land Management, as an example, has cooperated with respect to the national land reserve. Thus, the survey is not limited, but is, rather, as broad in scope and agency participation as is required to meet the agreed-upon objectives.

The entire Humboldt River Basin is being studied by segments identified as sub-basins. This report contains much information for study and use in understanding and solving some of the existing water and land resource problems in the Reese River Sub-Basin. The report presents opportunities for Federal-State-local project-type developments under the Watershed Protection and Flood Prevention Act, together with other opportunities for development and adjustment.

I wish to recognize the excellent work of the U.S. Department of Agriculture and the State Department of Conservation and Natural Resources in this cooperative effort. I consider that this report will serve the best interest of the people in the Humboldt River Basin and the State of Nevada.

Grant Sawyer

Governor of Nevada

HUMBOLDT RIVER BASIN SURVEY

REESE RIVER SUB-BASIN REPORT

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ORGANIZATION OF REPORT

The report on the Reese River Sub-Basin is divided into three main sections. The first section is an overall report on the sub-basin; the remaining two sections consist of Appendix I and Appendix II, respectively.

Appendix I is attached to all the report copies, and contains pertinent textual matter concerning the sub-basin which is of value to the general reader.

Appendix II is produced in a relatively limited number of copies. Its small appeal to the general reader renders it unsuitable for inclusion with the report copies for general distribution. However, this type of material does have potential value as an information reservoir for technicians, administrators, and resource managers concerned with the Reese River Sub-Basin. Copies of this appendix are available upon request.

SUMMARY

The Reese River Sub-Basin extends south from the central part of the Humboldt River Basin. The drainage is approximately 140 miles long, and varies in width from about 12 miles in the south to 45 miles at its north extremity. It lies mostly in Lander County, but includes land in both Eureka and Nye Counties. Besides Reese River and its tributaries, the area includes the Crescent Valley-Carico Lake Valley drainages. There are approximately 2,325,000 acres within the boundaries.

The first white man known to have explored the Reese River wilds to any extent was John Reese, after whom the river was named. In November 1854, near the future site of Battle Mountain, Reese left Colonel E. J. Steptoe's detachment of troops and civilians, who were returning from a search for a new route for troop movements between Camp Floyd, Utah, and Genoa, Nevada, and traveled up Reese River.

The sub-basin's history starts with emigrant trail establishment in 1855 between Salt Lake City and Genoa, and extends through the period of the freight and stage lines, about 1859; the Pony Express runs, 1860-1861; the mining era, 1862 to about 1896; to the present ranching industry.

Livestock raising, now the sub-basin's principal industry, got its start in 1862. Lewis R. Bradley, who became Nevada's second Governor (1870-1878), started the first large-scale ranching operations in Nevada, stocking the lush meadows of upper Reese River and the Toiyabe canyons north and south of Austin with thousands of Texas longhorn cattle.

The town of Austin grew up as a mining center in Pony Canyon at the site of William Talcott's silver discovery. It had a population of about 1,200 in 1863, and grew to approximately 10,000 by the early 1870's. Today Austin Township is the local headquarters for the ranching industry in the southern part of the sub-basin, with a population of 389, 1960 census.

Battle Mountain started as a railroad terminus for the mining activity in both upper and lower Reese River Valley. At present Battle Mountain Township has the largest population (1,177, 1960 census) of any town in the sub-basin; it is becoming important as a tourist stop, and as headquarters for several large ranching operations. There is still considerable mining activity in the vicinity of the town, principally barium.

The cover types of the sub-basin, unlike those of the upper Humboldt basin where big sagebrush-grass predominates, run to a greater percent of such desert species as shadscale and bud sage. Another highly desirable desert species present, which is not found in any significant amounts in the upper Humboldt Basin, is white sage. These desert shrub species are usually found on the benches, old lake terraces, and occasionally on the bottomlands.

Other species present on the bottomlands are the native pasture and hayland grasses and sedges, and phreatophytes common to the Humboldt Basin.

Present at elevations just above the bottom lands, and in some places extending to the mountain ridges, are such shrub species as big sagebrush, low sagebrush, serviceberry, and currants.

Conifers present are scattered stands of limber pine on the north slopes at the higher elevations, and pure to admixture stands of Utah juniper and single-leaf pinyon on the foothills, benches and terraces. Present in approximately the same elevation zone, and quite often on the opposite south-facing slopes from the limber pine, are extensive stands of curl leaf mahogany.

Such grasses as Sandberg bluegrass, Indian ricegrass, bottlebrush squirreltail, and cheatgrass form a thin understory to many of the stands of shrubs and conifers.

Along the stream bottoms and moister sites, principally at the higher elevations, are found a few deciduous trees such as cottonwood, aspen, and birch.

Of the 2,325,000 acres in the sub-basin, 72 percent is national land reserve, 11 percent national forest, .2 percent Indian Reservation, and 16.8 percent private land. In 1939, 4,681 acres of ranch land in upper Reese River were purchased by the Bureau of Indian Affairs and made into the Yomba Indian Reservation.

There are 32 livestock ranches with holdings in the sub-basin and 109 tracts of land entered under the Desert Land Act. In 1959 sales of products from the commercial ranches ranged from a low of $5,000 to $40,000 or more. Between 1944 and 1959, about 99 percent of the income derived was from the sale of livestock and livestock products. Average ranch size has slowly increased, with the larger ranches now averaging 9,000 acres.

Cattle numbers in Lander County have varied from a low of 11,000 head to a high of 38,000, and have presently leveled off at approximately 21,000. Sheep numbers have decreased from over 40,000 in 1934 to 11,000 head in 1959. This downward trend appears to be continuing.

Steers are the chief livestock product marketed, and account for about 32 percent of all cattle sold; cows 24 percent; mixed calves 24 percent; others 20 percent. Lambs and wool are the other livestock products sold, with 95,214 pounds of wool being shorn in 1959.

Cattle obtain approximately 50 to 60 percent of their feed requirements from the Federal and private intermingled rangeland. The remainder of their feed comes from the native irrigated pastures and haylands, and the sagebrush-greasewood-ryegrass areas fringing the private croplands. Sheep are essentially on the range year-long, and receive very little if any hay or supplemental feed.

Of the 2,119,300 acres of usable rangeland, approximately 2,001,400 acres are in the low forage production class, 113,200 acres in the medium, and 4,700 acres in the fairly high. The private and Federal range lands furnish approximately 201,000 A.U.M.'s of feed.

The water-balance studies for an 80 percent frequency (chance) flow year (expected to be equaled or exceeded eight out of 10 years) indicate that practically all the gross water yield goes into ground water as streamflows pass over alluvial fans. Total water available prior to agricultural and phreatophytic use is 33,800 acre-feet. There is one small irrigation reservoir in the sub-basin, with an estimated capacity of 475 acre-feet. Desert entries and stock water developments account for over 140 wells, with capacities ranging from a few gallons per minute to over 3,000.

This sub-basin has approximately eight percent more mountainous area above 8,000 feet elevation than the Ruby Mountains Sub-Basin, yet the Ruby area in an 80 percent frequency year produces an estimated six and one-half times more water. For this percent frequency or greater, there is little or no discharge of water from the sub-basin to the Humboldt River.

The range-type phreatophytes on 116,000 acres in the sub-basin are the principal users of available water. It is estimated these plants use 42,100 acre-feet annually. Of this amount, 30,900 acre-feet are used by nonbeneficial phreatophytes. By comparison, irrigated crops use only one-half the total amount used by phreatophytes, both beneficial and nonbeneficial.

The average annual precipitation varies from approximately six inches at Battle Mountain to 25 inches in the northern part of the Toiyabe range. The average frost-free period (28 degrees F) for the irrigated land varies from 118 to 130 days.

There is some culinary use of water in Battle Mountain and Austin. Also, there are many stock wells, stock ponds, seeps, and springs used by livestock.

Presently there are about 20,000 acres of land in the sub-basin which are irrigated when water is available, with alfalfa, grain, and native pasture and hay the chief crops. The hay lands and phreatophyte areas are generally located along the valley bottom lands. Most of the native hay and pasture land is irrigated continuously while the water lasts, during the early and late spring runoff. Middle and late summer water is available on limited areas.

On-the-farm irrigation efficiency is estimated to be quite low for the native meadows and haylands - 20 percent or less. Higher efficiencies are obtained on cropland under irrigation wells for the desert entries - probably close to 50 percent. About one-third of the land being irrigated has been improved by smoothing or leveling. This is principally on the desert entry lands. There is only a limited amount of controlled diversions, irrigation structures, pipelines, and concrete ditches. The bulk of the irrigation on native meadows is done by wild flooding, with little or no control. On the desert entry lands, irrigation is by borders, corrugations, and furrows.

The soil problems are high water table, poor drainage, and salt and alkali concentrations. Sheet erosion is prevalent over extensive areas in the sub-basin. Reese River is gullied throughout its length, and practically every tributary to Reese River has some degree of channel cutting and gully erosion.

The first specific record of extensive flood damage noted for the sub-basin was the dry-mantle flood of August 15, 1878, at Austin. The first wet-mantle flood to inflict known damage was that of January - May 1881; the entire sub-basin suffered property, erosion, and sediment damage, as well as livestock losses. The last and most damaging wet-mantle flood occurred in February 1962. Practically all the damage was confined to the north one-third of Reese River, and to northern Crescent Valley. The wet-mantle flood of 1910 also inflicted serious damage, and probably started much of the channel cutting and gully erosion now so universally prevalent.

Between these dates (1878-1962) seven wet-mantle and at least six dry-mantle floods have produced serious flooding, erosion, and sedimentation problems. During the period 1862-1963, Reese River, ordinarily dry in its lower reaches, has run its full course into the Humboldt at Battle Mountain only seven times. Each time the break-through was occasioned by one of these seven wet-mantle floods.

As the population increases, and with improved roads and trails, the sub-basin's recreation potential will become better known and developed. The Toiyabe Range-Shoshone Mountain area is presently one of the principal deer-harvest regions of central Nevada, and this type of recreation use is bound to increase. With fuller recognition and development of the largely untapped potentials for camping, picnicking, back-country travel, and delving in Nevada's exciting past by visiting the many historic sites located here, recreation use should become one of the sub-basin's outstanding features.

Fishing in upper Reese River and its Toiyabe tributaries, already one of the best between the northeast Nevada high country and the Sierra Nevada, can be improved even more. This improvement can be brought about with enhanced watershed management and rehabilitation measures, and stream channel stabilization, all of which will result in improved stream regimens and better fish habitats.

Regular Department of Agriculture and other Federal and State programs can provide assistance in accomplishing many needed improvements in the sub-basin. The regular programs of the Bureau of Land Management, including fire protection, provide for the protection and improvement of the Federal lands that agency administers, within the scope of currently available funds.

A review of the sub-basin indicates the water and related land resource problems in upper Reese River can best be handled on a project basis. In this area, improvement measures can be installed which will provide for flood prevention, watershed protection, store irrigation water, reduce erosion and sediment damage, and increase forage production on crops and range lands. A preliminary evaluation of the works of improvement proposed for the watershed area is sufficiently favorable to warrant a more detailed study of the possibility of a watershed protection and flood prevention project.

HUMBOLDT RIVER BASIN SURVEY

REESE RIVER SUB-BASIN REPORT

AUTHORITY AND ORGANIZATION

The need for continually improving the conservation and use of water and related land resources has long been recognized by Federal, State, and local agencies. A pertinent development of this continuing interest is River Basin studies under Section 6 of Public Law 566, as amended and supplemented. In Nevada such a survey is underway by the U.S. Department of Agriculture and the Nevada State Department of Conservation and Natural Resources.

The Secretary of Agriculture is authorized under the provisions of Section 6 of the Watershed Protection and Flood Prevention Act to cooperate with other Federal and with State and local agencies in making investigations and surveys of the watersheds of rivers and other waterways as a basis for the development of coordinated programs.

General direction for the U.S. Department of Agriculture in the conduct of the studies and preparation of the report was provided by a USDA Field Advisory Committee composed of representatives of the Soil Conservation Service, Forest Service, and Economic Research Service. The USDA River Basin Representative served as advisor and consultant to the committee.

General direction for the State of Nevada was provided by the Director of the State Department of Conservation and Natural Resources.

A Field Party, composed of representatives of the Soil Conservation Service, the Forest Service, and Economic Research Service completed the field work and prepared this report.

Grateful acknowledgement is made to all individuals and to the personnel of other State and Federal agencies who gave their counsel and technical assistance in the preparation of this report.

HISTORICAL INFORMATION

Settlement

The first white man known to have explored the Reese River wilds to any extent was John Reese, after whom the river was named. In November 1854, near the future site of Battle Mountain, Reese left Colonel E. J. Steptoe's detachment of troops and civilians, who were returning from a search for a new route for troop movements between Camp Floyd, Utah, and Genoa, Nevada, and traveled up Reese River.

As a result of these solitary wanderings along the length of the Reese River Valley, John Reese was appointed in 1859 as a guide for Captain J. H. Simpson, of the U.S. Topographic Engineers, and his party. Captain Simpson had been instructed by General Joseph Johnson, then at Camp Floyd, Utah, to find a route for a good military road between that point and Genoa, in Carson Valley.

During June 1859, Captain Simpson completed his survey, the line of which roughly approximated the cattle and emigrant trail established in 1855 between Salt Lake City and Genoa by Major Howard Egan, the Mormon guide, mountaineer, and cattle drover. The line of this survey became known as the Central Route, and a military road was shortly constructed along it by Colonel Frederick W. Lander. Late in 1859 Major George Chorpenning moved his "Jackass-Mail" and horse-drawn stages to this route from its original Humboldt River location. In April 1860, Jones, Russell & Company (soon changed to Russell, Majors, and Waddel) took over Chorpenning's mail contract between Carson City and Salt Lake City, and instituted the famous Pony Express runs between St. Joseph, Missouri and Sacramento, California.

Stations were set up on "the Pony" at Simpson Park, just east of the sub-basin, and at Jacobs Springs, near the east bank of Reese River. The latter station was named after Washington Jacobs, district agent in charge there; Jacobsville, the first town in the sub-basin, later grew up at this station. Another station was located at a gap through the Shoshone Range about 10 miles west from there, and three miles north of the present Railroad Pass on U.S. Highway 50. The route crossed through the Toiyabe Range about three miles north of Austin, from Simpson Park to Reese River, by way of Emigrant Springs, Yankee Blade, and Midas Canyon. Austin itself was never on the Pony Express route.

The reign of the Pony rider and his mochila was brief. In October 1861 the Pony Express was put out of business by the completion of the Overland Telegraph Company line between Sacramento and Omaha. Across Nevada the new telegraph line also followed Simpson's Central Route.

Just prior to the demise of the Pony Express, through stage, mail, express and freight service was inaugurated in July 1861 over the Simpson route by the Overland Mail and Stage Company, with Wells-Fargo Express collaborating. For the ensuing eight years, until the completion of the Central Pacific-Union Pacific Railroads in May 1869 at Promontory, Utah, the Central Route was the principal avenue of stage, mail, express, freight, and telegraphic communication, not only between eastern and western United States, but also between western and eastern Nevada. Indeed, previous to the Austin silver discovery in May 1862, "the Overland Mail created all the civilized life of the central and eastern part of the territory of Nevada" as Thompson and West state it. All the places of white habitation and activity in the entire Reese River-Crescent Valley area at that time were to be found along the Overland Stage road, where the company's men and their families were engaged in the care and maintenance of the stage stations, equipment, and the large herds of draft stock needed in its operation.

After the inception of staging operations in July 1861, the old dry Pony Express station in the Shoshone Range west of Reese River was moved to Mt. Airy Pass (see photograph 1), and after Jacobsville was abandoned as the Lander County seat in favor of Austin in 1863, the stage station there was moved two miles westward, to the east bank of Reese River. At about the same time, the Simpson Park-Midas Canyon section of the stage road was abandoned, and the road was rerouted to run over Austin Summit and down Pony Canyon through Austin.

In 1914 the Lincoln Highway, the first of the U.S. transcontinental auto highways, was routed along the old Overland road through Nevada, from Eureka westward. In 1925, it became U.S. Highway 50.

The discovery of the Pony silver ledge on May 2, 1862 by William Talcott, Overland Stage employee and former Pony Express rider stationed at Jacobsville, started the

Photograph 1. - Old Overland Stage road (1861) and original Lincoln Highway location (1914), Mt. Airy Pass, Shoshone Mountains, approximately 15 miles west of Austin, Nevada, looking northwest. Mt. Airy plateau in background; note ruins of Mt. Airy Stage Station in middle distance, right side of photograph.

FIELD PARTY PHOTO 6-796-2

"Reese River Excitement" as it became known. The sub-basin's largely pastoral type of economy was radically altered, and the use and exploitation of its timber, range, and water resources, as well as the mineral resources, started on a large scale. The towns of Clifton and Austin - named after the great Texan by some of his countrymen in the town - grew up in Pony Canyon at the site of Talcott's discovery. By March 1863, at the time newly created Lander County's (December 1862) first officials took up their duties, the county population totalled slightly more than 2,000; 1,200 of these lived in Austin.

Jacobsville, being the oldest settlement, became the county seat of Lander County. The new county was named after the Army officer of that name who had constructed the military road along the Simpson route. However, after the first general election in September 1863, Austin easily won over Jacobsville and Clifton as the choice for the permanent county seat. The county government has remained there since, in spite of periodic efforts by Battle Mountain in later years to claim the honor. Early in 1864 Clifton, Austin, and Upper Austin were all combined and incorporated as the City of Austin. By the early 1870's the city's population had grown to approximately 10,000; Jacobsville, the first county seat, had been reduced to a single ranch headquarters, the home of Washington Jacobs.

By mid-1863, in addition to the four towns named above, there were at least four other bustling communities in the canyons of the Toiyabe and Shoshone Ranges north and south from Austin in the sub-basin - "all cities of great expectations", as one source has

it. In the Toiyabes, they were: Amador and Yankee Blade, in the canyons immediately north of Austin; Canyon City and Lander City, in Big Creek Canyon; and Washington, in Washington Canyon. In the Shoshone Range north and west of Austin another mining camp, Ravenswood, bloomed briefly in the 1860's. During the 1870's it gained some importance as a cordwood and fuelwood center for the mines and mills of the Austin-Reese River area.

By 1896, following the demonetization of silver in 1893, the production of the Reese River mines had declined sharply, but during its hey-day Austin was second only to Eureka and the Comstock in the production of silver. Francis Church Lincoln lists Austin area's silver production from 1862-1902 at approximately $50,000,000; since that time, about $300,000. Austin become known as "the mother of mining camps". All mining activity which subsequently developed in central and eastern Nevada, from the White Pine excitement in 1868, Eureka in 1869, the various bonanza camps in Elko County, to the Tonopah strike in 1900, resulted from the waves of prospectors which periodically flowed out from the Reese River district.

All of the mining activity in the lower reaches of the Reese River Sub-Basin, including Copper Basin, Copper Canyon, Galena, Lewis and Hilltop, can also be attributed to strikes by prospectors from Austin. In Crescent Valley, the boom camps of Cortez, Lander, and Tenabo stemmed from Austin (see photograph 2). The only mining camp here whose antecedents cannot be traced directly to Austin is Gold Acres, in Crescent Valley, which was first developed in 1940 by the London Extension Mining Company (Colorado). This company mined and processed low-grade gold ore at the Gold Acres site until the cessation of all activity in 1961.

Photograph 2. - Ruins of Simeon Wenban's Cortez ore reduction mill, Cortez, on the southeast rim of Crescent Valley. Looking north, with the pinyon-juniper-covered and mine dump-scarred slopes of Mt. Tenabo in the background. FIELD PARTY PHOTO 6-773-7

Photograph 3. - Grade of dismantled Nevada Central Railroad (narrow gage), Reese River Canyon, looking north. Abandoned building at Canyon Station is visible in the left middle distance. FIELD PARTY PHOTO 6-798-5

Battle Mountain had its beginning in November-December 1869 as a station on the Central Pacific Railroad. It became the terminus for the toll, freight and stage roads to the Reese River, Galena, and Lewis mines, and by April 1870 had become a very lively town. The Central Pacific had originally established a station (November 1868) at Argenta, about eight miles farther up the Humboldt, to serve as the terminus for the Reese River mines. With the full development of the Lewis, Copper Basin, Galena and Copper Canyon galena and copper mines in lower Reese River, it was found expedient in 1869 to move the entire Argenta townsite to a new location, present Battle Mountain.

In the mid-1870's Battle Mountain became a competitor with Winnemucca, Carlin and Elko for the Cornucopia-Tuscarora-Bull Run freight and passenger traffic with the construction of a toll road up Kelly Creek and into upper Rock Creek. In 1879 it became the northern terminus and headquarters for the Nevada Central Railway, and also for the short-lived Battle Mountain and Lewis Railway.

With the decline of the mining industry in the 1880's and 1890's and the rapid expansion of the range livestock industry, Battle Mountain, because of its strategic location, became one of the principal Nevada livestock shipping points, and has so remained.

During the years from World War I to and including World War II, the Galena Range mines had a strong revival, and during this period Battle Mountain again became a terminal point for this mining traffic.

The Nevada Central Railroad was completed from Battle Mountain to Austin at midnight on February 9, 1880, barely in time to claim the $200,000 Lander County bond subsidy which was due to expire at that time. To help insure that the railroad would reach the Austin city limits in time, the Austin Common Council extended the

city limits westward and southward from Austin one-half mile, and hastily erected a small shack in the new "suburb". The Austin City Railroad, locally known as the "Mule's Relief", was built up Pony Canyon in 1880 from Clifton to Upper Austin, and extended in 1884 to the mines on Lander Hill, above Austin. The Battle Mountain and Lewis Railroad was completed in 1881 to Lewis from Lewis Junction, on the Nevada Central about 10 miles south of Battle Mountain.

The life of these two latter lines was brief; the service on B.M. & L. was discontinued by 1885, and the A.C.R.R. lasted not much longer. The Nevada Central ran until 1938, but was built too late to capitalize on Austin's boom period, which reached its peak and began to taper off gradually in the late 1870's. (See photograph 3.)

Livestock raising, now the sub-basin's principal industry, got its start in 1862, when Lewis R. Bradley, who became Nevada's second Governor (1870-1878), moved to the upper Reese River Valley from California with 500 head of Texas longhorn cattle shortly after the Austin boom flowered. With his son John Reuben and his partners George Russell and James Rooker, "Old Broadhorns" started the first large-scale ranching operations in Nevada, stocking the lush meadows of upper Reese River and the Toiyabe Canyons north and south of Austin with thousands of longhorn cattle.

In the 1880's, 1890's and early 1900's thousands of nomadic unregulated bands of sheep grazed the Toiyabe and Shoshone uplands. Much of the destructive overuse of these uplands was terminated with the establishment in March 1907 of the 600,000 acre Toiyabe Forest Reserve, now a part of the National Forest of that name.

The Taylor Grazing Act, placing much of the remaining public domain (national land reserve) under a managed grazing program, was passed in 1934. It was not until 1951, however, that the present Battle Mountain District of the Bureau of Land Management was created to administer most of the public domain lands in the sub-basin. A portion of these lands in Crescent Valley is administered by the Elko District of this agency.

The 4,681 acre Yomba Indian Reservation on upper Reese River was created in 1939 through the purchase of three ranches by the Bureau of Indian Affairs. At present it supports seven Shoshone Indian families. A reservation school is maintained on the reservation, near Stewart Creek on Reese River.

Portions of three soil conservation districts have operations in the sub-basin: The Austin, created June 1953; the Tonopah, created in June 1948; and the Humboldt River, created September 1950.

Floods

The Reese River Sub-Basin has been subjected to many periods of flooding and high water. The earliest recorded flood year along the Humboldt main stem was 1862. This flood period was just prior to the first population boom at Austin, and the amount of flooding and damage in the sub-basin is not definitely known, although passing references to it have been found in early editions of the Reese River Reveille and other sources.

For further information on the history of floods and high water in the sub-basin, refer to a subsequent section on flood damage in this report.

Fires

There have been several damaging fires in the sub-basin prior to 1947. However, since that date, only four have been large enough to cause significant watershed damage. Two of these burned in the Crescent Valley portion of the sub-basin, and two in Reese River. The two Crescent Valley fires, Mill Canyon (August 1957) and Frenchie Flat (July 1947), each burned over 10,000 acres of mixed Federal-private ownership in the foothills and higher watershed lands of the Cortez Mountains. The Mill Canyon fire was particularly damaging in that it removed the sorely needed pinyon-mountain mahogany cover on the extremely steep northern and western slopes of Mt. Tenabo, north of Cortez.

In Reese River, the Fish Creek Basin Fire (1957) in the Shoshone Mountains burned more than 300 acres of national land reserve range and watershed. In July 1958 the Veatch Canyon Fire south of Austin on the Toiyabe National Forest burned an estimated 400 acres of higher watershed pinyon-juniper and sagebrush-grass lands.

POPULATION

Lander County is sparsely populated, having only one community with a population of 1,000 or more. Population per square mile has averaged between 2.9 and 3.3 for the past 70 years. There has been a 15.5 percent decrease in population during the last 10 years. This was preceded by a six percent increase for the preceding ten-year period, as indicated in the following tabulation:

Total population, with percentage changes, Lander County, 1890 - 1960

Year	Population	Percent change
1890	2,266	-----
1900	1,534	-32.3
1910	1,786	+14.1
1920	1,484	-16.9
1930	1,714	+15.5
1940	1,745	+ 1.8
1950	1,860	+ 6.0
1960	1,566	-15.5

Source: U.S. Population Census.

Battle Mountain is the largest population development in the area (1,177, 1960 census). Tourist trade supports a portion of the population in this sub-basin, which is crossed by U.S. Highways 40 (Interstate 80) and 50, two main transcontinental tourist routes east and west.

PREVIOUS STUDIES

There have been no studies made and published for this sub-basin from the standpoint of overall water use or watershed problem analysis. Localized studies have been made for small areas which pertained primarily to desert entries.

Photograph 4. - Toiyabe (Arc) Dome, Toiyabe Range, the highest peak in the Humboldt Basin (11,788 feet). Looking northwesterly across the headwaters of Reese River.
FIELD PARTY PHOTO

Photograph 5. - Smith Flat, an upland basin at the head of Moss Creek, Shoshone Range, between Reese River and Carico Lake Valleys. Looking west (downstream) toward the basaltic gorge which drains into Reese River Valley. The former rye-grass cover here, desiccated by gullying, has given way to an overstory of rubber rabbitbrush and big sagebrush. FIELD PARTY PHOTO 6-788-9

U.S. Geological Survey

A survey of the upper Reese River bottomland was made in 1935 and published as Plan of Reese River, Nevada, consisting of three sheets: A, B, C.

Ground water studies have been made in Crescent Valley and in the Middle Reese River and Antelope Valleys by the U.S. Geological Survey in cooperation with the State Department of Conservation and Natural Resources (Water Resource Bulletin No. 15, and Ground Water Resources - Reconnaissance Series, Report 19, respectively).

Other Studies

Other technical reports covering limited or specialized fields have been made at various times in the sub-basin. Their titles are listed in the reference section of this report.

GENERAL SUB-BASIN CHARACTERISTICS

The Reese River Sub-Basin extends south from the central part of the Humboldt River Basin. Besides Reese River and its tributaries, the area includes the Crescent Valley-Carico Lake Valley drainages. The sub-basin is approximately 140 miles long, and varies in width from about 12 miles in the south to 45 miles in the north extremity. It lies mostly in Lander County, but includes land in both Eureka and Nye Counties. There are approximately 2,325,000 acres within the boundaries.

Physiographically the sub-basin includes three land forms: The mountain highlands; the valley uplands; and the valley lowlands (see photographs 4, 5, and 6). The west boundary is formed by a series of mountain ranges, from the Shoshone Mountains on the south, and extending northward through the New Pass, Augusta, Fish Creek, and Galena ranges. These mountain ranges have crest elevations from 7,000 to 8,000 feet, with peaks varying from 8,696 feet to 10,351 feet above sea level. The Shoshone Mountains traverse the sub-basin in a north-south direction. Reese River cuts through the range about half way down its length, at Reese River Canyon. North from this point, the Shoshone Mountains form a boundary between the Reese River and the Carico Lake Valley-Crescent Valley drainages. The Toiyabe Range comprises the southern three-fourths of the sub-basin's eastern boundary; the Cortez Mountains the northern one-fourth. The Toiyabe Range has crest elevations of 10,000 feet, with peaks over 11,000 feet. One of these, Toiyabe (Arc) Dome, is the highest peak in the Humboldt Basin, at 11,788 feet above sea level (see photograph 4). The Cortez Mountains crest between 7,000 and 8,000 feet, and have peaks ranging to 9,162 feet above sea level (Mount Tenabo).

Geology

Older rocks are exposed in mountain ranges, and include slate, quartzite, schist, shale, chert, conglomerate, altered volcanics and carbonate rocks. Granodiorite, quartz monzonite, diorite and granite intrude these rocks and are exposed at scattered locations in the Toiyabe, Shoshone, and Cortez Ranges. Younger volcanic flow rocks and some interbedded sediments overlie the older rocks throughout large areas of mountain ranges in the sub-basin. The younger valley fill consists of lake deposits, with some interbedded volcanic ash, tuff and other flow rocks, alluvial fan and flood plain deposits.

Photograph 6. - Valley lowlands, Cane Creek, Antelope Valley, looking westerly toward Home Station Gap (left background) and Mt. Moses. Note desert entry cultivated areas. FIELD PARTY PHOTO 6-797-2

The present basin and range physiography has been controlled largely by block faulting and tilting of rock masses. Both uplifting of mountain blocks and down-dropping of valleys are believed to be important processes responsible for the present regional physiography. The mountain masses are in general rugged, exhibit considerable relief, and are drained by both intermittent and perennial streams which have incised deep canyons on their flanks.

Terraces, pediments, alluvial fans, and playas are important land forms in the valleys. The alluvial fans consist of detritus deposited at the mouths of canyons and washes adjacent to topographically high mountain fronts, terrace scarps, pediments or older dissected alluvial fans. The alluvial fans flanking mountain fronts in many areas have coalesced to form a continuous slope (bajada) with an undulating upper surface. Alluvial fans are interbedded with silty mud flows and other fine material. The alluvial fans form one of the most prominent landscape features in Crescent and Reese River Valleys.

Graded erosional surfaces occur widely on older valley fill and alluvial fan deposits. These surfaces are mantled by a veneer of gravelly alluvium, in which soils with medium to strong morphological characteristics have developed. The surfaces are graded toward levels which may be different from the present levels because of down-cutting or aggradation that has occurred since formation of the surface. A narrow flood plain bordered by older terraces or encroaching alluvial fans occurs along intermittent stretches of Reese River. The flood plain is apparently developed on older stream alluvium deposited after a prior period of down-cutting.

The Humboldt River at the mouth of Reese River Valley and Crescent Valley is nearly at grade, and forms a local base level for down-cutting by Reese River in lower Reese River Valley. Presently, lower Reese River Valley appears to be an area of slow aggradation. A playa occupying the lower part of Crescent Valley forms a temporary base level for down-cutting in that valley. Base levels tend to slowly rise due to aggradation, but denudation by wind may cause a lowering of base level, which will exist as long as the valley is internally drained.

Between U.S. Highway 50, near Austin and Reese River Canyon, Reese River is deeply entrenched in the valley fill at one location. Several terraces are developed along this reach of the river, and are apparently the result of several periods of alternating erosional stability and down-cutting in Reese River Canyon. South of U.S. Highway 50 down-cutting apparently occurred in the past, but aggradation on the large alluvial fans encroaching on the valley from the Toiyabe Range to the east, and Shoshone Mountains to the west, has been rapid enough to replace sediment removed by erosion.

Ground Water

Practically all ground water is derived from precipitation within the sub-basin. Drainages may flow below springs or during periods of runoff from snowmelt or storms, but when discharging from higher elevations they normally lose their surface flow in alluvial fans or stream-associated alluvium on the valley floor. The older rock in these mountains appears to be well consolidated, which would indicate that water movement out of the basin is slight.

Ground water available for use is stored in ground water reservoirs in valley fill. Younger valley fill deposits are mostly unconsolidated, and in addition to including fan and stream alluvium and playa deposits, also include much silt, fine-grained sand, and clay deposited below piedmont slopes. Better aquifers appear to be stream-deposited sand and gravel associated with larger intermittent drainages. Fair aquifers occur on the west side of Crescent Valley, where wells yielding over 1,000 gallons per minute are located along the toe of fans between Mud Spring Gulch and Corral Creek.

Throughout much of Reese River Valley, south of Reese River Canyon, unconsolidated deposits are believed to be generally thin and most of the available ground water is probably stored in aquifers in partially consolidated older valley fill.

Depth to older valley fill deposits in the sub-basin is generally unknown, except for those areas in which pediments are developed on them, or where they are exposed. In general, these older valley fill deposits contain a high proportion of fine-grained materials. They store large amounts of ground water, but usually do not yield large amounts of water to wells. However, exceptions occur in some locations where good aquifers were encountered in the older deposits.

Soils

The soils have been developed from combinations of igneous, metamorphic, and sedimentary rock, and partially consolidated sediments. Soils in the higher elevations are shallow to moderately deep, well drained, and are medium textured; some stony or gravelly medium textured soils are included. On the upland benches and terraces the soils are generally moderately deep to deep, moderately well to well drained, and are medium textured. There are some areas where the soil is moderately deep over a cemented pan. The bottomland and flood plains have soils that are deep to very deep, imperfectly to poorly drained and medium to moderately fine textured; salt and alkali concentrations range from none to strong. (See Soils Description and tables 6 and 7, Appendix I.)

Precipitation

Average annual precipitation on the irrigated lands in the sub-basin is estimated to vary between six inches around Battle Mountain and Beowawe to 10 inches in the southern portion of Reese River Valley.

Precipitation in the mountainous areas changes with location of storm patterns and difference in elevation. Information based on data from stations in and adjacent to the sub-basin, and on the water balance studies made by the Field Party, indicates the average annual precipitation to be as follows:

Toiyabe Range precipitation varies by elevation from 12 to 20 inches in the southern part (elevation 7,000 to over 11,000 feet) and 10 to 25 inches in the northern part (elevation 6,000 to over 11,000 feet).

Shoshone Range precipitation varies by elevation from 12 to 15 inches in the southern end (elevation 7,000 to over 10,000 feet) and eight to 15 inches in the north (elevation 6,000 to 8,500 feet). Around Mount Lewis (elevation 9,680 feet) the precipitation is estimated to be 20 inches.

Cortez Mountains precipitation varies by elevation from eight to 15 inches (elevation 5,000 to 8,500 feet). Around Mount Tenabo (elevation 9,162 feet) the precipitation is estimated to be 20 inches.

Fish Creek Mountains and Galena Range precipitation varies by elevation from eight to 15 inches (elevation 5,000 to 8,000 feet).

Average annual precipitation for recording stations in and around the sub-basin is as follows:

Station	Elevation	Years of record	Average annual precipitation (inches)	Extrapolated annual precipitation 1/ (inches)
Beowawe	4,695	92	6.5	----
Battle Mountain	4,530	93	6.6	----
Austin	6,543	71	11.9	----
Yomba School 2/	6,655	8	7.4	9.0
Ione (gage on Reese River) 2/	6,986	10	9.9	11.0
Kingston Summit 2/	8,500	7	15.8	16.0

1/ Based upon long-term records at Austin.
2/ Storage gages.

Growing Season

The average annual temperature for towns in the sub-basin differs by only one or two degrees. U.S. Weather Bureau records indicate these temperatures to be 49 degrees F at Beowawe (79 years), 48 degrees F at Battle Mountain (32 years) and 47 degrees F at Austin (66 years).

Average length of growing season (28 degrees F) for the irrigated lands in the sub-basin varies from an estimated 118 days in the north to 130 days in the south. U.S. Weather Bureau Records indicate a frost-free period of 118 days at Battle Mountain, 123 at Beowawe, and 133 at Austin.

Photograph 7. - Sheet and gully-eroded greasewood flats, valley bottomlands of lower Reese River, 15 miles south of Battle Mountain. Looking east toward snow-covered Mt. Lewis. FIELD PARTY PHOTO 6-797-7

General Cover Types

The cover types of this sub-basin mark the transition between those of the upper Humboldt sub-basins - where big sagebrush (Artemisia tridentata)-grass is generally predominant - and the cover types of the middle and lower Humboldt, which run to a greater percentage of such desert species as shadscale (Atriplex confertifolia) and greasewood (Sarcobatus vermiculatus).

In the Crescent Valley and Carico Lake Valley portions of the sub-basin, and along Reese River bottomlands from Battle Mountain to the narrows north of the Reese River-Fish Creek confluence, greasewood, either in an almost pure stand or with a scattered admixture of rubber rabbitbrush (Chrysothamnus nauseosus) forms the principal brush overstory (see photograph 7). As an understory to the greasewood, or interspersed with it, saltgrass (Distichlis stricta), alkali sacaton (Sporobolus airoides), Great Basin wildrye (Elymus cinereus), and bottlebrush squirreltail (Sitanion hystrix) are found, with cheatgrass (Bromus tectorum) appearing on the less saline sites. Such salt-tolerant plants as seepweed (Suaeda spp.), pickleweed (Allenrolfea occidentalis), green Molly (Kochia americana), and Bassia (Bassia spp.) make up the principal forbs.

Ground cover density of this understory varies from practically nothing in some of the poor semi-playa range sites to a fairly heavy grass-forb understory in the more productive or less damaged areas of the saline bottomlands. However, these latter are scattered, and few in number.

Photograph 8. - *Extensive rubber rabbitbrush overstory, saline bottomland site along Reese River. Looking northeasterly toward the Toiyabe Range, approximately 30 miles north of Austin, Nevada.* FIELD PARTY PHOTO 6-791-1

Photograph 9. - *Shadscale-budsage site in low forage production class, lower Reese River Valley, looking north toward the Humboldt River at Battle Mountain, 15 miles distant. Shadscale is the dominant plant species, with budsage, scattered big sagebrush, fanweed and other annuals also present.* FIELD PARTY PHOTO 6-797-6

Photograph 10. - *Winter fat type, silty desert flats site, lower Gilbert Creek, upper Antelope Valley, looking northward toward Mt. Moses. The type here, although in a more vigorous condition than elsewhere in the sub-basin, is being desiccated by a large gully (not visible), and slowly invaded by big sagebrush, shadscale, and cheatgrass. The winter fat and bud sagebrush plants are widely spaced, pedestalled, and with only a sparse understory of Sandberg bluegrass.* FIELD PARTY PHOTO 6-796-4

Southward from the narrows below the Reese River-Fish Creek junction, and in Crescent Valley from Hot Springs Point southward toward Cortez Canyon, rubber rabbitbrush makes up a greater portion of the overstory of the saline bottomland site (see photograph 8). It comprises from 25 to 45 percent of the total plant cover. On the fringes, greasewood, usually two feet or less in height, becomes dominant in the overstory. Buffaloberry (Shepherdia argentea) and thin stringers of willow (Salix spp.) are also found along the upper Reese River main channel, from the Visbeek Ranch southward.

With exception of the desert entry areas in upper and middle Reese River and in Antelope Valley, all the irrigated and semi-irrigated native or improved hay meadows in the sub-basin are located in these bottomland sites, primarily in the saline bottomlands.

Extensive shadscale types extend upward across the fans and terraces on each side of the bottomland area in Antelope Valley, and in the Reese River Valley from approximately U.S. Highway 50 northward (see photograph 9). Large acreages of the shadscale type are also found in the same locations in Crescent-Carico Lake Valleys. There are only a few relict areas remaining of the once extensive winterfat (Eurotia lanata)-bud sage (Artemisia spinescens) types which occupied much of the present shadscale sites. The most prominent are along the northern fringe of Antelope Valley, east of the old Cottonwood Ranch; along Gilbert Creek, in southeast Antelope Valley; and on the flats at the upper east side of Carico Lake Valley, near the Hall Creek outflow area (see photograph 10).

Another winterfat remnant is located west of the Reese River bottom, a short distance south of U.S. 50. The winterfat type in Antelope Valley is the remnant of a once extensive acreage of the species which covered the upper Antelope Valley basin, but which has been replaced by an almost pure stand of the relatively worthless green Molly.

South of U.S. 50, big sagebrush occupies the upland benches and terraces on each side of the valley bottomlands, with a sparse understory of cheatgrass or, less frequently, such perennial grasses as Sandberg bluegrass (Poa secunda), Nevada bluegrass (Poa nevadensis), or bottlebrush squirreltail.

Toward the upper elevational limits of the big sagebrush-grass type, particularly in the upper valley of Reese River, low sage (Artemisia nova-A. arbuscula) usually with a bluegrass understory, supplants the big sagebrush. Scattered bitterbrush (Purshia tridentata) is often intermixed in the big sagebrush and low sage types throughout the sub-basin.

The mountain slopes above these sagebrush areas are generally covered with a stand of pinyon (Pinus monophylla), Utah juniper (Juniperus osteosperma), or an admixture of both (see photograph 11). In the Shoshone Range, juniper predominates, usually being found in pure stands. In the Toiyabes, the converse is true. In both areas, the understory varies with the density of the pinyon-juniper canopy. The more open tree canopies often have a considerable understory of serviceberry (Amelanchier alnifolia), big sagebrush, Indian ricegrass (Oryzopsis hymenoides), and the widely distributed cheatgrass.

Above this conifer belt in the Toiyabe Range the higher slopes of the Toiyabe National Forest are usually covered with a low-density mixture of low sage (Artemisia arbuscula) or big sagebrush with a thin bluegrass-forb understory. On the steep slopes and along the ridge tops at all the drainage heads, thick stands of mountain mahogany

Photograph 11. - Single-leaf pinyon and Utah juniper stand, Toiyabe National Forest. Looking south across the head of Yankee Blade Canyon, in the Toiyabe Range four miles north of Austin, Nevada, toward Bunker Hill and Reese River Valley. (Note faint line of old Pony Express-Overland Stage road across hillside, middle distance). FIELD PARTY PHOTO 6-802-1

Photograph 12. - Head of Stewart Canyon, Toiyabe Range within the Toiyabe National Forest, looking west across Reese River Valley to the Shoshone Mountains. Note the limber pine stands on the north exposures (left foreground) and the heavy mountain mahogany cover on the south exposures, typical vegetal cover at the higher elevations of these Toiyabe drainages into Reese River Valley. FIELD PARTY PHOTO

(Cercocarpus ledifolius) are found on the southern and western exposures, and limber pine (Pinus flexilis) on the north exposures (see photograph 12). These limber pine stands were dense and extensive enough to have been logged in the mining boom of the 1860's and '70's, particularly at the heads of Sawmill, Little Sawmill, and the other canyons heading around Arc Dome (see Settlement).

On the higher slopes and mountain tops in the Mt. Lewis-Maysville Summit-Granite Peak section of the Shoshones, between Reese River and Crescent Valley, are found the only extensive relict areas of the low sage-bluebunch wheatgrass (Agropyron spicatum)-Nevada bluegrass type in the sub-basin. Heavy overuse of the high, open uplands of the Shoshones, Toiyabes, the Galena Range and the Cortez Mountains by sheep in the last twenty years of the Nineteenth Century and the first ten years of the Twentieth has almost completely eliminated the bluebunch wheatgrass-Nevada bluegrass understory to the sage types in all the mountain ranges of the sub-basin.

Cottonwood (Populus fremonti) and willow stringer types are found in the canyon bottoms of the north Shoshone Range, in the Mt. Lewis section, and in the Galena Range canyons. In the Mt. Lewis canyons (Lewis, Dean, Trout Creek, Mill Creek) the cottonwood gives way to thin aspen (Populus tremuloides)-willow-serviceberry stringers in the canyon heads and basins. The same is also true for the canyons of the Cortez Mountains. South of Big Creek, in the Toiyabe National Forest the creeks (Washington, Cottonwood, San Juan, Tierney, Stewart) have stringer types along their lower portions, with aspen, willow, and birch along their upper reaches and in the higher basins (see photograph 13). Along the channel of upper Reese River, from the upper narrows to the vicinity of the Stone Cabin Ranger Station, groves and clumps of cottonwood appear at scattered intervals, intermixed with the willow and aspen stringers lining Reese River, Sawmill Creek, and other drainages. The large basin at the two forks of Stewart Creek has the most extensive aspen type in the sub-basin, and probably the only one with a semblance of the original perennial grass-forb understory still present.

Water Yield

Reese River Sub-Basin is an area of generally low precipitation and low water yield. The sub-basin does not contribute flow to the Humboldt River except in years of abnormal precipitation or unusual weather conditions.

The water balance studies, and evidences of scanty surface outflow from the sub-basin, indicate that a major portion of the gross water yield is subsurface runoff. Much of this water eventually finds its way into the substantial groundwater storage basins which underlie many of the valley areas in this sub-basin. Generally, the only areas where surface flow is available for irrigation are in the mountain valleys and on the upper reaches of alluvial fans. There are areas along Reese River where returning ground water is used to irrigate relatively large acreages of cropland.

There are several hot spring areas in the sub-basin. The ones in Crescent Valley have a small annual flow (200 acre-feet) and one in middle Reese has an annual flow of 1,300 acre-feet. It was assumed that all the springs originate within the boundaries of the sub-basin.

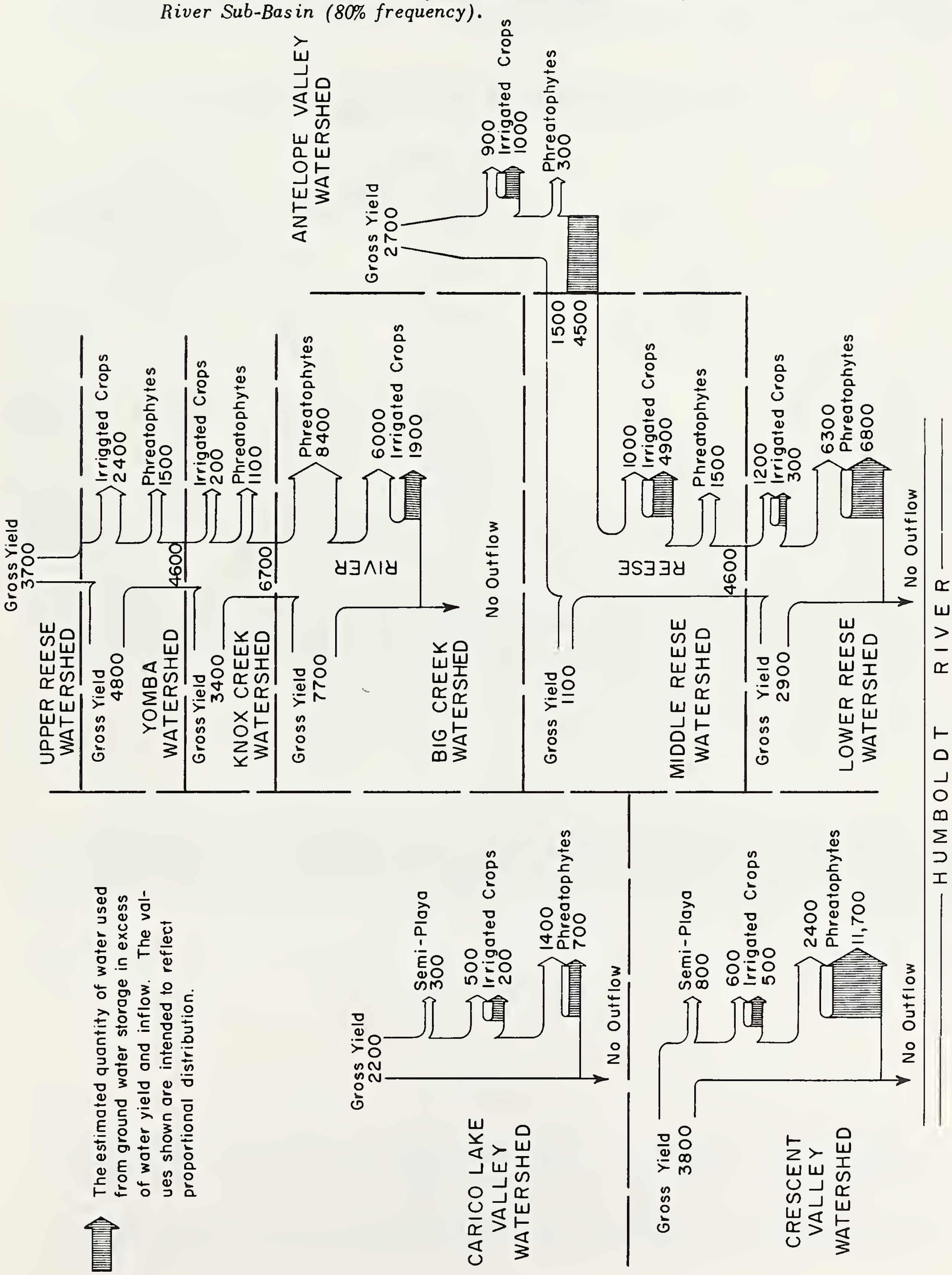
A small reservoir on Iowa Creek, upper Carico Lake Valley, has an estimated capacity of 475 acre-feet; it is the only surface irrigation reservoir in the sub-basin.

Photograph 13. - Aspen clumps, willow stringers, and big sagebrush-grass make up the bottomland vegetation in this typical Toiyabe west-side canyon. San Juan Creek, Toiyabe National Forest, looking south. Note the building ruins on the left, remnants of the old mining camp of San Juan. FIELD PARTY PHOTO 6-744-9

There are an estimated 40 or more water wells in the Crescent Valley-Carico Lake Valley drainages. They have capacities varying from one or two gallons per minute to 1,600 g.p.m. At present, four of these are being used for irrigation. In the Reese River drainage there are an estimated 100 or more wells with capacities ranging from a few gallons to 3,000 g.p.m.; currently about 65 are used for irrigation.

This sub-basin has approximately eight percent more mountainous area above 8,000 feet in elevation than the Ruby Mountains Sub-Basin, yet the Ruby area produces an estimated six and one-half times more water. There are any number of factors that might cause this difference in water yield, including location of storm patterns.

Figure 1.--Flow diagram of gross water yields and depletions in acre-feet for the Crescent-Carico Lake Valleys and Reese River drainages in the Reese River Sub-Basin (80% frequency).



A flow diagram of the estimated gross water yields and depletions for an 80 percent frequency (chance) year for watersheds in the sub-basin is illustrated in figure 1. (See also Annual Water Balance Studies, Appendix I.) Following is a water balance summary from the diagram:

Water Balance Summary, 80 Percent Frequency (Chance)

	Crescent-Carico Lake Valleys		Reese River	
	Acres	Acre-feet	Acres	Acre-feet
Gross Water Yield: 1/	710,000	6,000	958,000	26,300
Inflow:	-------	-----	-------	------
Subtotal		6,000		26,300
Uses and Losses:				
Irrigated Crops	1,400	(-) 1,800	18,500	(-) 19,800
Phreatophytes	46,000	(-) 16,200	70,000	(-) 25,900
Evaporation from semi-playas	2,200	(-) 1,100	------	------
Discharge to Humboldt River	-------	------	------	------
Subtotal		(-) 19,100		(-) 45,700
Total (excess use and loss) 2/		(-) 13,100		(-) 19,400

1/ Gross water yield, for the purpose of this study, is the estimated available water, both surface and subsurface, prior to agricultural and phreatophytic use. Generally, this water yield is estimated for a stream or streams at a point above the highest diversion for the main body of irrigated land on a flood plain of a valley.

2/ See Water Use, this report.

It has been suggested by geologists and others that subsurface flow from Buffalo Valley, a small closed basin west of lower Reese River, discharges into lower Reese River Basin. The quantity, however, would probably be insignificant, and was not considered in calculating the water yield for this area.

LAND AND WATER USE

Land Status

There are an estimated 260 land owners in the sub-basin, not including lands within the boundaries of municipalities or other small tract sub-divisions. These ownership data were obtained from the Bureau of Land Management at Elko and Battle Mountain, the Soil Conservation Service Work Unit offices at Elko and Austin, and the Agricultural Stabilization Conservation Service at Austin. Sections of Federal and private (formerly railroad) lands are intermingled in a checkerboard pattern along the north end of the

sub-basin. Included in the private land are an estimated 124,300 acres owned by the Southern Pacific Railroad, and 300 acres occupied by the towns of Battle Mountain and Austin.

The approximate land status breakdown is as follows:

Land Status	Square miles	Acres	Percent of total
National Land Reserve	2,627.8	1,681,800	72.4
National Forest	396.7	253,900	10.9
Indian Reservation	7.3	4,700	.2
County and State	1.3	800	---
Private	599.7	383,800	16.5
Total	3,632.8	2,325,000	100.0

Land Use

As directed by the Multiple Use-Sustained Yield Act (Public Law 86-517) of 1960, the Forest Service administers the lands within the Toiyabe National Forest to coordinate the various uses of resources - outdoor recreation, range, mineral, timber, watersheds, and wildlife and fish - without impairment of the productivity of the land. Uses on these valuable watershed lands must be carefully coordinated to avoid resource damage. Practically all of the water yield in this sub-basin, south from Highway U.S. 50, originates on the high-elevation national forest watersheds in the Toiyabe and Shoshone Mountains.

The Yomba Indian Reservation lands are used for the production of crops and range forage. The crop lands are divided into seven individual ranches; the range land is used in common by the ranch holders. (See photograph 14.)

The national land reserve lands are used primarily for domestic livestock. Grazing licenses are issued on the basis of spring-fall, winter, and summer range use, depending upon location and type of range. Portions of these lands also serve as winter range for big game and as a year-long habitat for other wildlife. The long-range land program of the Bureau of Land Management includes encouragement of land exchanges, in order to establish a more desirable land pattern, particularly on high watershed lands. Recreation is expected to be an important phase of the Bureau of Land Management program. The Bureau's proposed recreation development program is briefly discussed in the recreation and wildlife section of this report.

Private lands are used for the production of irrigated crops and range forage. In many instances exchange of use agreements and private land permits are granted the owners of private intermingled lands, and these areas are then administered with public lands by the land administering agency. The bulk of current grazing on national land reserve range is on community allotments, although a few individual allotments have been established and division of the range into individual allotments is progressing.

Most of the irrigated land is used to produce winter feed for livestock. Other crops grown, primarily on desert land entries, are irrigated pasture, small grain, and alfalfa for seed. (See photograph 15.)

Photograph 14. - Indian ranch headquarters and hay lands, Yomba Indian Reservation, upper Reese River Valley. Looking northeast across the valley toward the Toiyabe Range in the vicinity of Washington, Cottonwood and San Juan Creeks.

FIELD PARTY PHOTO 6-770-10

Photograph 15. - Irrigated wheat field, desert entry lands, lower Cane Creek in middle Reese River Valley, looking northerly toward the Shoshone Mountains.

S.C.S. PHOTO 6-557-1

Water Rights

Practically all water rights in the sub-basin are vested rights (claims to surface water initiated prior to 1905 and continuously used since; they are subject to determination through juridical proceedings). In the Reese River drainage only Silver Creek water has been adjudicated: 345 acres with 1,635 acre-feet of water. In Carico Lake Valley two streams, Carico Creek and Crum-Wilson Creeks, have been adjudicated, for a total of 966 acres with 2,227 acre-feet of water. On all these streams the adjudications provide for varying quantities of water per acre, ranging from 1.5 to six acre-feet.

Water Use

The water balance studies made by the Field Party indicate that the annual water requirements for irrigation, phreatophytic growth and surface water evaporation are greater than the estimated gross water yield as frequently as six to seven years out of 10. It is assumed that the additional water required for these purposes is available from the substantial ground water storage which underlies a large portion of the alluvial valleys in the sub-basin.

Estimated annual requirements for an 80 percent frequency (chance) year are as follows:

	Crescent-Carico Lake Valleys		Reese River	
	Acres	Water use acre-feet	Acres	Water use acre-feet
Irrigated crops	1,400	1,800	18,500	19,800
Phreatophytes	45,900	16,200	69,600	25,900
Evaporation from semi-playas	2,200	1,100	------	-----
Discharge to Humboldt River	-----	------	------	------
Total		19,100		45,700

Based upon the more or less consistent quantity of water used by phreatophytic type growth from year to year, the present rate of pumping for irrigation, and the relatively small effect these uses have on the ground water table in these large basins during dry years, it is assumed that the ground water storage remains in balance over a cycle of wet and dry years. This being the case, it is reasonable to assume that in those years when available supply exceeds use and loss (three to four years out of 10) a major part of the excess recharges the ground water basin.

In Reese River Valley south of the Lander-Nye County line, irrigation is all from surface flow. This area includes the land in the Yomba Indian Reservation. North of the county line the cropland is irrigated either from surface runoff, returning ground water, pumping from ground water storage, or from a combination of these sources. This area includes about 6,300 acres under desert land entries which are irrigated entirely with water pumped from ground water storage.

In the Crescent-Carico Lake Valleys some ranches irrigate their cropland with surface runoff as their only source of water; others supplement the surface supply by pumping from ground water storage or by using returning ground water. A small acreage receives its full season water requirement from storage in the Iowa Creek Reservoir. This

Photograph 16. - Irrigation well, desert entry lands, lower Antelope Valley, looking west. Mt. Moses and the Shoshone Mountains in the right background. S.C.S. PHOTO 6-557-3

Photograph 17. - Land leveling, Crescent Valley, looking westward toward Mt. Lewis in the Shoshone Mountains. S.C.S. PHOTO 6-313-1

area includes the desert land entries, which are irrigated entirely with water pumped from ground water storage (see photograph 16). A few ranches pump water to supplement surface flow.

In the Crescent-Carico Lake Valleys only a small acreage is irrigated entirely by surface flow - the land under Iowa Creek Reservoir and a few mountain meadows in both valleys.

Irrigation Methods

Approximately one-third of the land being irrigated has been improved by smoothing or leveling (see photograph 17). Most of this work has been done in conjunction with the development of irrigation wells, or the installation of pipe lines or concrete ditch lining. The improved fields are irrigated principally by the border method, although furrows and corrugations are also used, depending on the type of crop grown. The irrigated land south of the Lander-Nye County line has had few improvements; it is mostly irrigated by flooding from direct diversion of stream flow.

There are an estimated 4,000 acres of land referred to as flood plain meadow which are located mostly along stream channels. These lands are used to grow native hay and pasture, and receive most of their water supply from shallow ground water; in high water years, these lands receive stream overflow.

Limited use has been made of sprinklers for the total irrigation requirements. A few of the desert land entries use sprinklers primarily to start new seedings.

THE AGRICULTURAL INDUSTRY

Agriculture is dominated by the range livestock industry. Currently, livestock enterprises consist almost entirely of the production and sale of feeder cattle, lambs and wool. Livestock numbers on sub-basin ranches, based upon Bureau of Land Management licenses and Forest Service grazing permits for 1963, were estimated at 12,000 cattle and horses and 20,000 sheep. Of the total livestock feed required, the Federal and intermingled private rangelands furnish forage for approximately 125,000 A.U.M.'s of cattle and horses and 76,000 A.U.M.'s of sheep.

Ranch Characteristics

The boundary of Reese River Sub-Basin approximates that of Lander County; therefore, the characteristics of Lander County are fairly representative of the sub-basin. The U.S. Census of Agriculture provides an overall picture of agriculture typical of Lander County.

By census definition, in 1959 there were 22 farms in Lander County. All farms were commercial-type range livestock ranches, as shown in the following tabulation:

Farms by type, Lander County, 1949-1959

	1949	1954	1959
		(Number)	
All farms	33	26	22
Commercial farms	32	21	22
Livestock farms other than dairy & poultry	25	21	22
Poultry	7	0	0

Source: U.S. Census of Agriculture.

Fourteen farm operators in the county, or 64 percent, were full owners of land they operated in 1959. There were six part owners (28 percent), and one manager-operated and one tenant-operated farm. Although there were more farms in years prior to 1959, the tenure and operating pattern were very similar. (See table 11, Appendix I.)

Five farms in 1959 had sales of $40,000 or more; nine had sales from $20,000 to $40,000, and the remaining eight from $5,000 to $20,000. (See table 11, Appendix I.)

Between 1944 and 1959, about 99 percent of the income from agricultural products in Lander County was derived from the sale of livestock and livestock products. Income from the sale of crops decreased from 2.1 percent in 1939 to .01 percent in 1959. No dairy products were reported sold after 1944, and only a small income was derived from the production of poultry and poultry products.

Value of ranch products sold in Lander County, 1939-1959, was as follows:

Item	1939 (dols.)	1944 (dols.)	1949 (dols.)	1954 (dols.)	1959 (dols.)
All ranch products	549,113	609,871	1,171,034	959,849	1,323,762
All livestock & livestock products sold	511,659	606,390	1,165,704	949,139	1,323,572
Livestock & livestock products other than dairy and poultry sold	504,002	593,903	1,163,146	946,858	1,322,573
Dairy products sold	11,596	6,572	---------	------	---------
Poultry & poultry products sold	1,085	883	2,558	2,281	999
All crops sold	11,571	3,406	5,330	10,710	190
Vegetables sold	185	100	193	10,000	---------
Crops sold percent of all ranch products sold	2.1	.5	.4	1.2	.01
Livestock & livestock products other than dairy and poultry percent of all ranch products sold	91.7	97.3	99.5	98.6	99.9

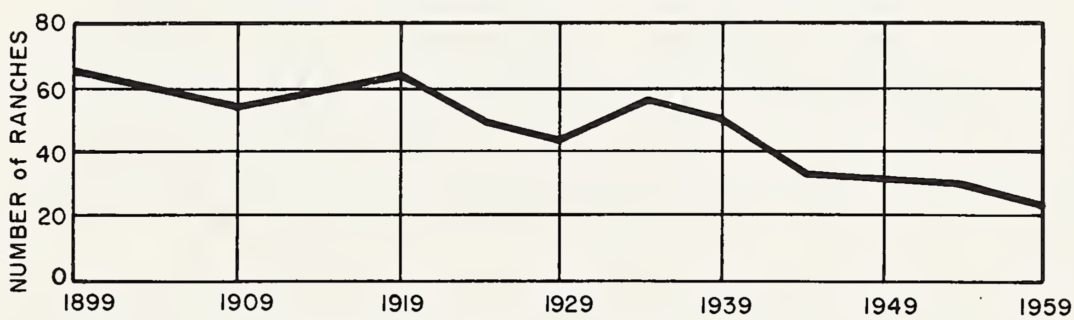
Source: U.S. Census of Agriculture.

Ranch expenditures, both capital and operating, have been on the increase. Cost of feed for livestock and poultry in 1959 increased over 200 percent above 1954. Gas and other petroleum expenses increased even more than feed during the same period, because of more mechanization (see table 12, Appendix I). Total operating expenditures for 1959 were $1,097,670, and gross income from the sale of all ranch products was $1,323,762, leaving a return of $226,092 to operator's labor and management, capital investment, and miscellaneous expenses. This return does not include any change in inventory that might have occurred.

Number of Ranches

Ranch numbers in Lander County ranged from 69 in 1899 to 22 in 1959, as shown in the figure below. From 1934 to 1959 ranch numbers steadily decreased. The major consolidation of small ranches into fewer large ranches took place during 1942 and 1943.

Number of ranches, Lander County, 1899-1959



Source: U.S. Census of Agriculture.

There are 32 livestock ranches with holdings in the sub-basin. Of this number, 19 have headquarters there. At least 25 of the 32 are commercial-type ranches deriving the major portion of their income from the production of livestock and livestock products.

In addition there are 109 tracts of land entered under the Desert Land Act. Some of these entries are operated separately and some are combined into larger units under one operator. The crops raised are primarily alfalfa and grain. A few small noncommercial hobby-type holdings also are found in the sub-basin.

Ranch Size

Average size of ranch in the sub-basin increased slowly until the early 1940's. Because of consolidation of smaller ranches, ranch size doubled from 1939 to 1949. Total acreage of land in ranches has also increased since 1949, primarily because of accelerated desert land entry activity. From 1949 to 1959 there was little change in ranch size. (See table 11, Appendix 1.)

According to the census of agriculture for 1959, 36.4 percent of the ranches in Lander County had less than 1,000 acres (mostly over 500 acres), and 63.6 percent had over 1,000 acres (see table 13, Appendix I). The two largest ranches in the sub-basin are 7,000 and 11,000 acres, respectively.

Yomba Indian Reservation

The Yomba Indian Reservation is located at the southern end of the Reese River Sub-Basin. Three ranches with grazing privileges on national forest and national land reserve lands were purchased by the Bureau of Indian Affairs in 1939 for the use of a band of Shoshone Indians. The total acreage purchased was 4,681, of which 2,044 are irrigable. Since the Indians have taken over the land the largest area irrigated has been 1,634 acres. Many small tracts have been consolidated, in order to increase the acreage of meadow land assigned to each operator; the present average is 234 acres. In 1951 there were 15 full time operators, but at present this number has been reduced to seven. A total of nine operators is the goal of Bureau of Indian Affairs, to be realized by 1965. In 1963 there were 64 persons living on the reservation. Several families, not in the livestock business, receive old age pensions or work off the reservation most of the year.

The investment per ranch is approximately $40,000 for all assets. The income trend per ranch is upward, and should approach a net of $5,000 per ranch unit.

Reese River, which runs through the reservation, is the primary source of irrigation water. Production depends principally on the amount and time of runoff, and upon water management. The irrigated acreage has varied a great deal because of the fluctuation in water available from year to year. The acres harvested have varied from about 400 to slightly over 1,600, averaging approximately 1,000 acres over the 16 years of record.

In 1941, the Indians harvested the following crops: Alfalfa hay, 169 acres; meadow hay, 729 acres; wheat, 22 acres; barley, 37 acres; potatoes, 20 acres; truck garden, six acres; and pasturage, 15 acres. The market value of these crops was $11,761. In 1963 there were 850 acres of meadow hay, two acres of garden, and 100 acres of pasture, with a market value of $11,400. Over this 22-year period, a significant price increase took place which rendered the decrease in total returns much larger than the figures indicate. The change in crop types produced and the resultant decrease in value of the products was primarily caused by continuing sedimentation from accelerated channel erosion and damage or destruction of irrigation structures from early spring floods. This has made irrigation difficult if not impossible in most areas.

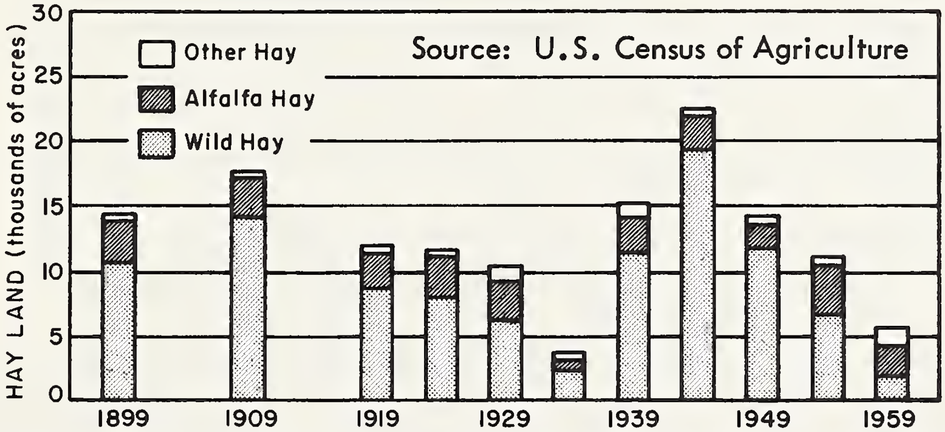
In 1951 beef cattle numbered 1,421 head on the reservation; six ranch operators owned over 100 head of cattle each. This total dropped to 434 in 1961. The main factors contributing to this decrease included poor markets, drought, and lack of leadership and management. In 1962 livestock loans were made by the tribe to four operators, which resulted in an increase of over 300 head of breeding cows on the reservation. A wet season that year increased range feed and hay production, allowing more cattle to be held over, bringing cattle numbers to 787 head in 1963. The outlook is for over 1,000 head of breeding cows to be permitted on the range in 1964.

Crop Production

During the first decade of the Twentieth Century, cropland harvested in Lander County averaged over 15,000 acres annually, with a high in 1909 of 22,000 acres, according to the census of agriculture. From 1910 to 1934, acres harvested decreased to less than 5,000 acres. Harvested cropland increased rapidly after 1934, reaching an all-time high of 22,500 acres in 1944. This was because of a period of above normal precipitation years with adequate and timely runoff. During that period some nonirrigated

wet meadows were harvested, but since 1944, because of generally droughty conditions most of the cropland harvested has been irrigated. The acreage of harvested cropland remained about the same for the next four years. Both 1954 and 1955 cropland acreage and yields were low, but 1956, 1957 and 1958 showed a sizeable increase in yield as well as acres of cropland harvested, as shown in the following figure. Drought in 1959, 1960, and 1961 reduced acres of harvested cropland to an all-time low since 1934.

Hay acreage, Lander County, 1899-1959



Crops grown on 19,900 acres in 1963 consisted of 1,800 acres of alfalfa, 5,400 acres of grain, 8,000 acres of irrigated hay and pasture, and 4,700 acres of flood plain meadows.

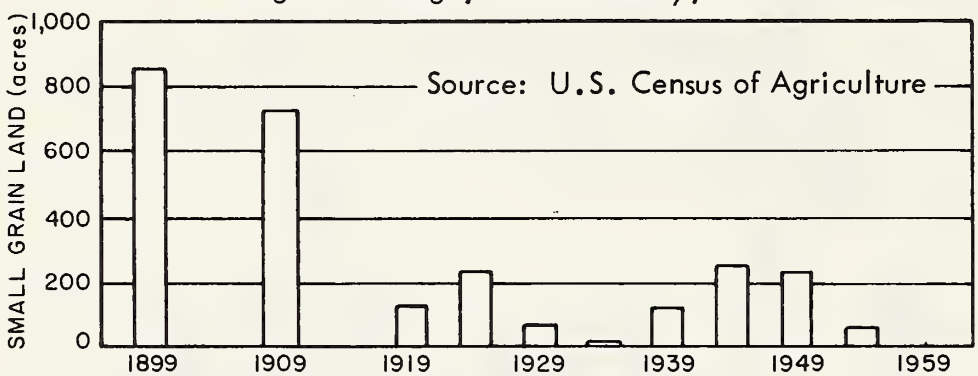
Crop yields vary from year to year, depending upon such factors as available water, length of growing season, and management. Alfalfa yields vary from 1.0 to 3.5 tons per acre harvested, averaging 2.75 tons for two cuttings; in 1963 about 255 acres of Walcott alfalfa were harvested for seed. Native grass meadows yield from .4 to 1.5 tons per acre harvested, averaging .9 of a ton. Some of the acreage listed as irrigated hayland has been planted to improved grass-legume mixtures. The irrigated pastures and flood plain meadows yield from one to three A.U.M.'s of feed per acre annually; improved irrigated pastures on desert land entries under deferred-rotation management are estimated to be producing at least five A.U.M.'s per acre (see photograph 18).

Photograph 18. - Steers and heifers grazing on improved irrigated pasture (alta fescue and alfalfa), Reese River Valley. Such improved pastures, under deferred rotation management, produce at least five animal unit months per acre.

S.C.S. PHOTO 6-699-3

Wheat, barley and oats are the primary small grain crops grown in the sub-basin. Until recent years there has never been a large acreage of grain grown in Lander County or the sub-basin; in 1899, the census of agriculture reported 857 acres grown in the county. Grain acreage generally decreased, with minor comebacks, until 1959, at which time no grain was reported grown in the county, as shown in the following figure:

Small grain acreage, Lander County, 1899-1959

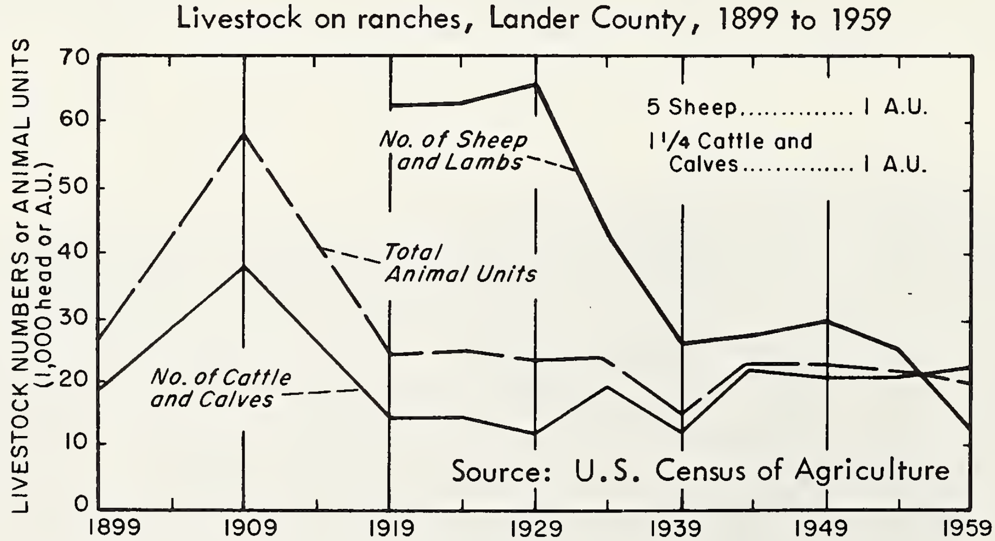


From 1959 to 1963 there was an increase in desert land entries in upper and middle Reese River and Antelope Valley. This, along with Crescent Valley, comprises all the desert land entry activity in the Reese River Sub-Basin. According to the Bureau of Land Management, 31,580 acres have been allowed entry under this act in the Reese River drainage, with a potential of 29,370 acres of irrigated land if the entries are fully developed. In 1963 there were 5,400 acres of irrigated grain harvested in the sub-basin, yielding an average of 25 bushels per acre. Oats averaged 26 bushels per acre and barley 34 bushels. Desert land entry farms are the primary producers of grain in the sub-basin.

Livestock Production

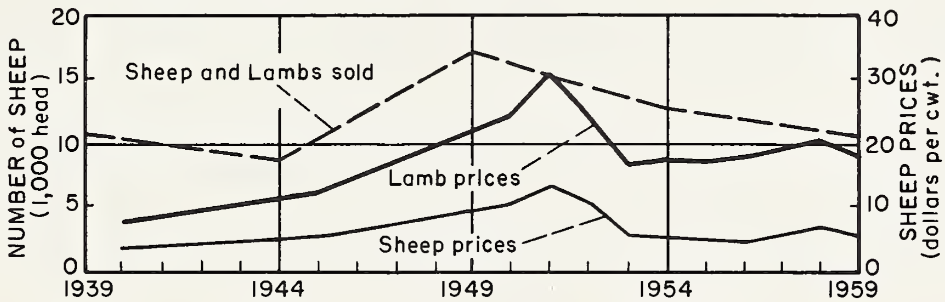
During the first thirty years of the Twentieth Century, many sheep grazed the rangelands of the sub-basin, with a high of 137,480 head in 1909. From that year through 1919, and again through the 1930's, sheep numbers were sharply reduced. Sheep numbers in Lander County varied between 20 and 30 thousand for the next 15 years (1939-1954). By 1959, sheep numbers had dropped to 11,500, an all-time low for the century, as shown in the following figure:

Livestock on ranches, Lander County, 1899 to 1959



Nevada cull ewe prices climbed from \$4.85 per hundredweight in 1930 to an all-time high of \$13.10 per cwt. in 1951; by 1962 the price of cull ewes had fallen to \$5.04 per cwt. Lamb prices followed the same trend, varying from \$7.10 per cwt. in 1930 to \$30.10 in 1951, and down to \$17.92 in 1962. Numbers of sheep and lambs sold during the past 20 years have followed the same trend as prices (see the following figure).

Price per cwt. and number of sheep and lambs sold alive, Lander County, 1939-1959



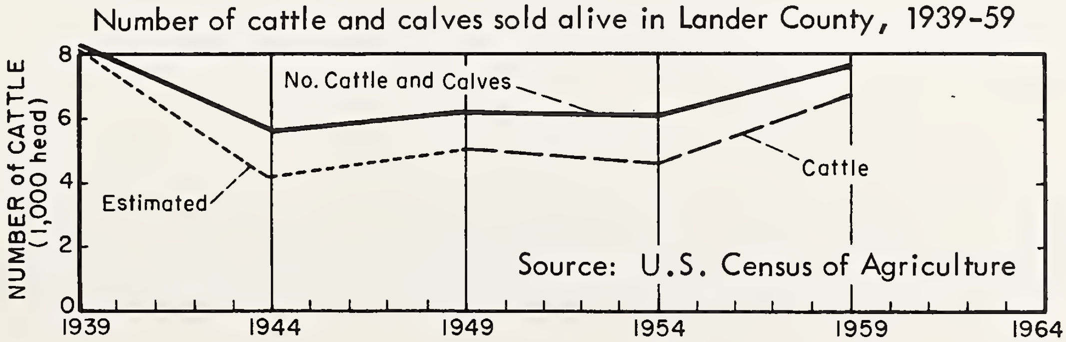
Source: U.S. Census of Agriculture

There are four major sheep operators with licenses or permits on Federal land in the sub-basin. Four other operators have small crossing permits, to cover sheep bands using driveways across these lands. Sheep in this area are on the range yearlong. Some sheepmen gather their bands during lambing time, feed them hay and grain, and assist the lambing ewes. At present, salable lamb crop is about 80 percent, based on numbers of mature ewes.

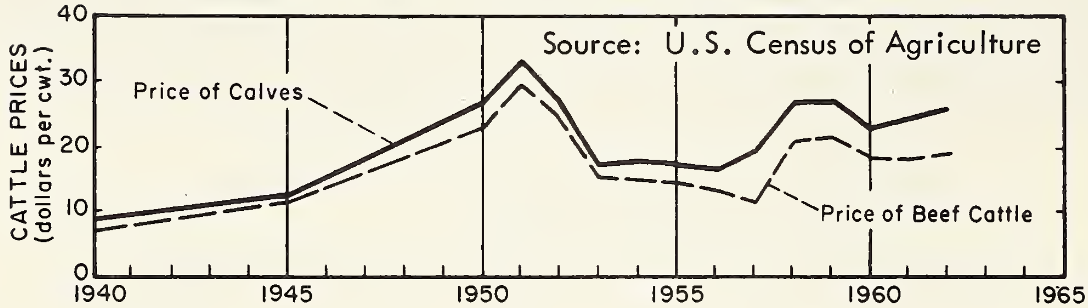
Numbers of cattle and calves on ranches in Lander County were at an all-time high of 38,000 head in 1909. By 1919 cattle numbers had dropped to 13,000 head, and remained between 11,000 and 19,000 head until 1944, when they climbed to 21,800 head. Since 1944, cattle numbers in the county have remained quite constant.

Between 1939 and 1944, prices of cattle and calves began to rise. Nevada cattle prices rose from \$6.10 to \$11.80 per cwt. and the price of calves rose from \$7.10 to \$12.60 per cwt. This increase was large enough to entice ranchers to increase sales. Prices continued to climb through 1951, but dropped sharply from 1952 to 1956. Ranchers continued to increase sales of cattle and calves, and high prices were received again in 1958 and 1959, as shown in the following figures.

Number of cattle and calves sold alive in Lander County, 1939-59



Nevada price per cwt. for cattle and calves, 1940-62



Cattle graze on Federal and intermingled private rangeland for 50 to 60 percent of their feed requirement. Crop aftermath and adjacent dry and irrigated pasture furnish from 15 to 20 percent of the feed requirement; hay provides the remaining 20 to 25 percent. The stronger cattle are left on the range longer, while the weaker cattle and springer heifers are gathered at the home ranch and fed.

Calves are born year-round under present management, but some ranchers try to have cows bred in May and June to get January and February calves. Calf crop varies from ranch to ranch, ranging from 75 percent to below 40 percent; the average calf crop in the sub-basin is about 50 percent.

Weaning weight of spring calves in the sub-basin ranges from 250 to 350 pounds, depending on date of birth, available forage and heredity growth potential, and averages 300 pounds. Some ranchers in the sub-basin sell weaner calves, while others hold them over to be sold as short or long yearlings.

Livestock Marketing

Lander County ranchers shipped 11,378 head of cattle and calves to reported destinations in 1959. According to a study made at the University of Nevada, the major classes shipped were steers, 31.9 percent; cows, 24.1 percent; and mixed calves, 24.0 percent. The 1959 U.S. Census of Agriculture reported 10,757 sheep and lambs sold, and 95,214 pounds of wool shorn in the county. Cattle, calves, sheep, lambs, and wool are the only agricultural exports of significance from the county.

The majority of livestock are contracted for sale, or sold at the ranch periodically. Buyers generally pay all shipping costs to their feed yards or packing plants.

California packers and feeders received 63.5 percent of the cattle shipped from the county in 1959. Idaho was second, receiving 16.7 percent, and 11.5 percent remained in Nevada but were shipped to another county. Nebraska and Utah shared the remaining 8.3 percent of cattle shipped.

California market demands for all in-shipments of cattle have grown over a 20-year period (1940 to 1959) at 3.75 percent per year, but Nevada shipments to California over the same period have increased only 2.34 percent per year for all classes. If post-war years (1947 to 1959) are used, there has been only a slight increase in numbers shipped for combined slaughter and stocker-feeder purposes. The number of cattle shipped to California for immediate slaughter has decreased, mainly through changes in grade demanded by California packers.

Transportation

For Lander County, trucks hauled 87.2 percent of the cattle in 1959. Eight and two-tenths percent traveled by rail, and 4.6 percent were not reported. For the sub-basin, because of the lack of rail transportation, an even larger percentage of cattle moved by truck.

Western Pacific and Southern Pacific serve the northern portion of the county, and provide daily schedules from Battle Mountain to the west coast, and to Ogden and Salt Lake City and points east. Both railroads offer livestock transportation service, with loading facilities at Battle Mountain and Beowawe. The primary highways serving the sub-basin are U.S. Highway 40 (Interstate 80) and U.S. Highway 50, east and west through Battle Mountain and Austin respectively. Nevada Highway 8A between Austin and Battle Mountain and Nevada Highway 21 through Crescent Valley, both north-south routes, connect these main thoroughfares.

WATER-RELATED PROBLEMS IN THE SUB-BASIN

Agricultural Water Management

Seasonal Distribution of Water

Snowmelt runoff usually occurs from April through June, with peak flows in May. Time and quantity of flow in streams throughout the area vary considerably, however, depending upon soil and climatic conditions.

Lands irrigated from direct diversion of surface flow, for the most part, receive but one irrigation during the spring runoff. The exception to this is in the south end of Reese River Valley, where Reese River has a longer period of sustained flow, and in other parts of the sub-basin where fields are irrigated with water from springs, a reservoir, and in one instance, conveyed from a stream channel through a concrete ditch.

Generally, the conditions resulting from short seasonal stream flow are more favorable for the growing of low-yielding forage plants which tolerate wide extremes in soil moisture over extensive periods of time.

Soils

The principal soils problems on irrigated land are high water table, poor drainage, and salt and alkali concentrations. These problems usually occur in the Humic Gley and Alluvial Soils which are found on the flatter slopes in the valley bottoms.

Ground cover density reduction on the range areas, particularly on the upland bench and terrace and intermediate mountain slope sites, has led to considerable topsoil loss through sheet erosion. This has resulted in gravel-paved surfaces, and loss of plant litter and soil fertility. (See photograph 19.)

Seepage Loss

Water loss from surface to ground water was observed to be very high in ditches and stream channels flowing over alluvial fans. During years with low precipitation this seepage loss limits the acreage which can be irrigated. (See photograph 20.)

Photograph 19. - Almost complete removal of vegetal cover by heavy grazing, both domestic livestock and big game, has bared this steep slope at the head of Reese River to topsoil loss through both sheet and rill erosion. This has resulted in pedestalling or partial burial of the few remaining browse clumps, and formation of an erosion pavement. FIELD PARTY PHOTO

Photograph 20. - Concrete irrigation ditch, Visbeek Ranch, Big Creek, looking northwest across Reese River Valley south of Austin. This concrete ditch lining effectively reduces excessive water losses from surface to ground water. At the present time, however, the ditch is in need of maintenance. FIELD PARTY PHOTO 6-797-4

Drainage

In some areas, salt and alkali concentrations and high water table limit the type of crops that can be grown, and crop yields. Most of the trouble spots are small in area, and are caused by returning ground water.

Irrigation Efficiency

On-the-farm irrigation efficiency (amount of water required to bring soil in the root zone to field capacity, divided by the amount of water applied) is variable throughout the sub-basin. On fields that are irrigated with pumped water the efficiency is estimated to range from 20 to 50 percent. Fields that are flood-irrigated from surface run-off usually obtain less efficient water use, estimated to be less than 20 percent.

Control of Water

Iowa Creek Reservoir is the only storage reservoir in the sub-basin. It is difficult to obtain the best use of water and increase crop yields without the development of a late season water supply. In addition, controlled diversions, more field ditches, additional pipe lines and ditch lining, and the necessary turnouts and drops are needed.

Flood Damage

The Reese River Sub-Basin has been subjected to many periods of flooding or high water. Both flood types - wet-mantle and dry-mantle - have been destructive, in terms of recorded flood, erosion, and sediment damage.

The wet-mantle flood results from the complete saturation of the soil mantle, to the point of overland flow. This condition is brought about by extended periods of warm winter rain, rain-on-snow or frozen ground during the winter months, or the rapid melting of abnormal snow accumulations in the spring.

The dry-mantle flood is primarily a summer occurrence, resulting from relatively short periods of heavy rain from summer thunderstorms on dry soils with a thin or depleted vegetal cover, whereby the soil mantle is only superficially wetted by the beating rain. Most of the sudden downpour then runs off in the form of overland flows. The dry-mantle type occurs less frequently along the Humboldt, and is usually confined to the stream sources on the higher watersheds, although it often can (and does) cause severe localized downstream damage. Through the years, this flood type has caused extensive property damage in the town of Austin, as well as in Lewis and Crum Canyons, east of Battle Mountain.

To prevent damage to stores and residences along Austin's main street from these dry-mantle floods, after 1878 there appeared two adornments peculiar to Austin architecture. These were (1) iron or heavy wooden "storm doors", to keep flood water and debris from ground floors, and (2) swinging outside stairways to second-floor living quarters, which could be raised out of harm's way when flood waters came roaring down Pony Canyon.

Wet-Mantle Floods

January - May 1881. - The wet-mantle flood year of 1881 inflicted erosion damage, some property damage and destruction, and livestock losses all along Reese River. The flood period was not as severe in the sub-basin as a whole as it was in other portions of the Humboldt Basin.

May - June 1884. - Austin was flooded on May 20 by a heavy rain-on-snow at the head of Pony Canyon. A wall of water four feet high hit the Manhattan Mill and the sawmill and woodyard above town, and most of its force was dissipated there. Not much damaging floodwater reached Clifton, but Austin's main street was filled with mud, sand and debris from the mill area.

By May 28 the swollen Reese had washed out the line of the Nevada Central Railroad at the Walters Ranch, 40 miles south of Battle Mountain; full service was not restored until June 4. Additional high water on June 11 brought more flood damage. The Reese River Valley between Ledlie Station, below Austin, and Silver Creek was described as a vast lake.

A large irrigation diversion on Reese River at the Walter B. Sheehen Ranch above Austin was washed out, and 25 miles of Nevada Central trackage between Clifton and the north end of Reese River Canyon were washed out or undermined. Train service was completely cut off between Austin and Battle Mountain from June 12 to 18, and resumed only on a limited basis for several days thereafter. On June 17 Reese River flowed into the Humboldt, but there was no flooding at Battle Mountain.

At Beowawe, a pattern developed which was to be repeated through all the heavy wet-mantle floods in the ensuing years. On May 31, floodwaters down Coyote Creek from Crescent Valley combined with the Humboldt floodwaters to produce flooding in the town; 12 to 18 inches of water flowed through Beowawe's streets.

January - February 1886. - Flooding and high water developed along Reese River from Austin to Battle Mountain from a prolonged and massive rain-on-snow storm period, January 16 to 24. Floodwater, erosion and sedimentation damage occurred along the entire Reese drainage system. Battle Mountain was described as "a seaport town", from the combined floodwaters of Reese River and the Humboldt, which joined forces early in February, but evidently the town was not flooded.

March - June, 1890. - High waters rolled on the Reese, as on all other Humboldt Basin streams, from the breakup of the "White Winter" of 1889 - 1890. Reese River is known to have reached the Humboldt at Battle Mountain, and produced some high water there. No record of property damage is available, but there was considerable livestock loss from drowning, miring, and starvation.

February - April 1910. - Reese River, flooding along its entire length, washed out over five miles of Nevada Central Railroad trackage through Reese River Canyon between Bridges Station and Ledlie. As near as may be determined, the 1910 flood marked the inception of the present deep channeling along upper Reese River. From all reports, a series of large beaver dams here were washed out, resulting in extensive stream bottom erosion, followed by bank undermining and channel widening. High water from Trout Creek and Mill Creek in the lower Shoshones, as well as from the canyons of the Galena Range, washed out several sections of the railroad closer to Battle Mountain.

Twelve bridges were washed away on the line, as well as many fill sections; $50,000 damages were inflicted. A gasoline motor car and a work train were left stranded; their crews reached Battle Mountain only after wading long distances in water ranging from knee to waist deep. Train service was suspended for almost three months, being finally restored early in July. The washed-out sections of the line through Reese River Canyon were the last to be rebuilt. During the period of reconstruction, a southern terminus was established at a temporary station in the canyon aptly named Bobtown. From here, freight and passengers for Austin and intermediate points were hauled by wagons and stages.

Battle Mountain was flooded extensively; to date, no detailed records of damage have been uncovered. At Beowawe, floodwaters from Coyote Creek, as well as high waters on the Humboldt main stem, put four feet of water on the floors of the hotel and a store building.

February - May 1952. - The high waters resulting from the melting of the 1951 - 1952 snowpack caused the first complete flooding of Reese River since 1910. The entire length of the stream was joined to the Humboldt for the first time since that date. However, Battle Mountain was not flooded, and U.S. 40 was not damaged. Not much property damage was incurred in the Reese River drainage, but there were crop losses and watershed damage from erosion, channel cutting, and standing water. Some livestock loss resulted from miring and starvation.

Buildings in Beowawe were flooded to a depth of three feet by Coyote Creek and Humboldt high waters. The lower (north) end of Crescent Valley became a lake, as did the semi-playa area in Carico Lake Valley.

February 1962. - Heavy rains-on-snow and frozen ground in the lower and middle Reese River basins and Antelope Valley caused flooding northward along the bottomlands. (See photograph 21.) There was no flooding on the upper reaches of Reese River, from Antelope Valley southward; upper Reese and its tributaries scarcely exceeded their usual winter depths. Lower Reese River, by February 1 swollen to many times its normal diminuative size by the raging waters of Cane Creek and Fish Creek in the Agusta and Fish Creek Mountains (see photograph 22), Galena Creek and Copper Basin in the Galena Range, and Crum, Lewis, Trout and Mill Creeks in the Mt. Lewis section of the Shoshones, formed a three mile lake behind U.S. 40, south and east of Battle Mountain. This lake then drained into Battle Mountain; floodwaters stood from two to five feet in depth over most of the town. Damages estimated at approximately $1,000,000 were inflicted on residences, business places, streets, and public buildings. Over 200 of Battle Mountain's 700 residents were evacuated from their homes. (See photograph 23.)

Photograph 21. - Washout of county road, Cane Creek, Antelope Valley, February 1962 wet-mantle flood. Looking westward toward Lone Peak, in the Augusta Range.
FIELD PARTY PHOTO 6-670-11

Photograph 22. - Flood debris deposited by overland flows and channel erosion, February 1962 wet-mantle flood. Fish Creek Basin, upper Fish Creek, looking northeast. FIELD PARTY PHOTO 6-798-11

Photograph 23. - Flooded Reese River at Battle Mountain, February 1962, dammed by U.S. Highway 40, in the foreground. Looking westerly, toward the Galena Range. FIELD PARTY PHOTO 6-670-6

The flood did not recede from the town until the U.S. Highway 40 and Southern Pacific grades were opened on February 12 and 13. Total damages to U.S. 40 and Nevada 8A up Reese River were estimated at $43,000. This flood resulted in livestock losses, severe sheet and gully erosion in Antelope Valley, Fish Creek Basin and lower Fish Creek, as well as lower Reese River and the Galena Range-Mt. Lewis drainages. One man lost his life at Battle Mountain.

Coyote Creek, along with high water from the Humboldt, flooded Beowawe on February 11 and 12. A store and three homes were inundated by 15 to 18 inches of water.

Dry-Mantle Floods

July 23, 1876. - A series of heavy summer thunderstorms struck across all of northern Nevada, resulting in several localized but severe dry-mantle floods during the afternoon. One of the most severe of these resulted from heavy rains around Mt. Lewis, at the headwaters of Maysville, Crum, Dean, and Lewis Canyons, south and east of Battle Mountain. The flood in Lewis Canyon swept through the bustling mining town of Lewis, carrying away every building, with the exception of the reduction mill and the boarding house. Portions of Ben Lewis' ranch (now the Martin Ranch) in the Reese River Valley below the canyon's mouth were heavily damaged by debris and sediment deposition.

In lower Crum Canyon, the flood carried away George Crum's dwelling and outbuildings, as well as wagons and other items. Along the stream bottom, cottonwoods 50 feet high were uprooted and swept downstream, along with extensive willow thickets and large quantities of stream bottom soil. Most of the Crum cattle were swept away, house-high boulders were carried miles downstream, and wagon wheels were later found 10 to 12 miles below the Crum house. The Bateman and Hovenden Ranches, on the Reese River floodplain three miles below Crum Canyon, also suffered considerable sedimentation and flood damage.

August 15, 1878. - At Austin, the first large scale instance of the classic pattern of thunderstorm dry-mantle flooding which has plagued the town throughout its long history took place. An immense volume of water, mud and rocks, three to 10 feet in depth, moved down Pony Canyon and along Main Street. The brick office of the Reese River Reveille was one of the first buildings to go. The floodwaters tore up sidewalks, wooden porches and sidewalk awnings, gutted store buildings, and sent the debris, intermixed with huge boulders, freight wagons, drowned horses, mules and cattle, cordwood from the mills, mine timbers, and fragments of small buildings down the canyon.

After the floodwaters receded, three feet of mud and debris filled the streets. In spite of an energetic rebuilding program, it was three months before all the damage was fully repaired. Subsequent to this flood, Austin citizens began to equip their Main Street buildings with the storm doors and outside upward-swinging stairways previously described.

July 28, 1952. - The same violent summer convection storm pattern which brought about the flooding of Galena Creek, west of Reno, was responsible for flows of water, mud, rocks, logs and other debris which emanated from many of the Toiyabe Range drainages south of Austin. No human lives were lost, nor was any property damage reported, but an erosion pattern of gullying, channel head-cutting and sheet erosion was stamped upon these Toiyabe watershed areas which will be difficult and costly to treat or heal. The principal drainages involved in this flooding were Washington, Tierney, and Marysville Canyons.

According to local residents, before this flood there was a larger and more uniformly sustained flow in these streams each year. Fishing was much better, and irrigation water available to the small hayfields at or near the mouths of these canyons lasted much longer than it has since the 1952 watershed damage.

July 1, July 31, August 1, 1953. - These three cloudbursts, following relatively closely upon each other, further deepened, intensified and extended the 1952 erosion pattern in Washington Canyon. Many storms of an intensity similar to these of 1953 had occurred before the 1952 freshet without causing outflows from these canyons. However, since 1952, any fairly sustained period of rain, as in 1953, is now quite likely to produce heavy flooding in not only these Toiyabe drainages into upper Reese River, but also those emanating from the Shoshones. The flooding in August 1963 from the southern Shoshone canyons, west of the Reese River, gave ample evidence of this fact.

August 6-28, 1961. - Watershed damage in Crescent Valley was caused by the same series of afternoon and evening thunderstorms which inflicted damage on Elko, railroad and highway damage along the Humboldt main stem, and in Pine Valley. This damage was in the form of severe channel cutting, mud-rock flows and sedimentation in Cottonwood, Brock, and adjacent streams draining the west slopes of the Cortez Range.

Vegetal Conditions

Range and Watershed

Watershed conditions over practically all this sub-basin are deteriorated, and the area is producing far below its forage potential. Within the Humboldt Basin, perhaps only one other sub-basin has more depleted and badly eroded range and watershed conditions (Sonoma; in particular, the Clear Creek Watershed). Table 1 indicates the acreage by classes of present annual forage production, grouped by soils for each vegetal type and site. The rates in this table are indicative of the total annual forage production, and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the owners or administrative agencies.

Rigorous exploitation and abuse of the range resource by domestic livestock, hordes of jackrabbits, and by big game over many portions of their Toiyabe summer range on upper Reese River and its tributaries, have adversely affected the watershed cover. No portion or section has been spared (see photograph 24). However, a few scattered small areas of pristine vegetal cover ramain, usually on areas so steep, inaccessible, or distant from water they have not been subjected to the abusive grazing use typical of most of the sub-basin.

Only on these limited sites, usually in the aspen or mixed browse-grass types of the steep mountain slopes and basins, can occasionally be found the bluebunch wheatgrass, Nevada bluegrass, Great Basin wildrye, little sunflower, and bitterbrush which formerly characterized most of these benches, basins and mountain uplands. The open slopes around the summits of Mt. Lewis, Mt. Moses, and widely scattered areas in the Toiyabe highlands are about the only such relict areas now remaining. (See photograph 25.)

Photograph 24. - Big sagebrush-grass range in the low forage production class, Crescent Valley. Looking easterly across Frenchie Flat in the east arm of Crescent Valley toward Frenchie Creek and the Frenchie Creek Ranch, Cortez Range in the background. The light-colored area in the middle distance is the lower extremity of the 10,000-acre Frenchie Flat Fire of 1947. FIELD PARTY PHOTO 6-771-11

Photograph 25. - Low sagebrush-grass range in medium forage production class, vicinity of Maysville Summit, on the east slope of Mt. Lewis. Looking southeast down Indian Creek toward distant Mt. Tenabo, in the Cortez Range. Principal grass species present are scattered bluebunch wheatgrass, Nevada bluegrass, and some bottlebrush squirreltail. There has been some sheet erosion, with resulting hummocking and pedestalling of grass and sagebrush clumps. FIELD PARTY PHOTO 6-778-4

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
1. Rabbitbrush-greasewood-grass; saline bottomlands	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	850-1,500	200-900	20-300	850-1,500	200-900	20-300	Brush removal by blading streambank and channel stabilization, erosion-proofing of roads, proper management and stocking.
A3-A6-S2	-----	-----	2,400	1,800	600	-----	
A4-H2	-----	-----	500	300	200	-----	
A5-A6-H2	-----	-----	14,100	12,000	2,000	100	
A5-A6-H6	-----	-----	10,200	8,000	2,000	200	
A5-A6-Y1-W1	-----	-----	22,500	13,000	9,000	500	
A5-A12	-----	-----	23,300	18,000	5,000	300	
A5-S2	-----	-----	17,300	9,000	8,000	300	
A6-A4-H6	-----	-----	10,100	8,000	2,000	100	
A6-Y1-W1 (60-20-20)	-----	-----	13,600	10,300	3,000	300	
A6-Y1-W1 (80-10-10)	-----	-----	10,100	8,000	2,000	100	
A6-Y1-W1 (40-30-30)	-----	-----	24,700	18,500	6,000	200	
A14-A13-Y1	-----	-----	23,500	13,000	10,000	500	
A14-S15	-----	-----	5,200	3,000	2,000	200	
B4-R1-L5	-----	-----	700	400	200	100	
B7-L6-R9	-----	-----	600	500	100	-----	
H1-A1	-----	700	7,700	6,000	2,000	400	
R11-L1-B4	-----	-----	400	300	100	-----	
S2-A7-B6	-----	-----	800	600	200	-----	
S2-A12-D2	-----	-----	25,600	13,500	11,500	600	
S2-S15-A2	-----	-----	200	100	100	-----	
S5-B2	-----	-----	800	600	200	-----	
S6-A2	-----	-----	400	300	100	-----	
S6-A2-B5	-----	-----	700	500	200	-----	
S6-B1-A12-G2	-----	-----	700	600	100	-----	
S6-B5-A2	-----	-----	600	500	100	-----	
Subtotal	-----	700	216,700	146,800	66,700	3,900	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
2. Semi-playa-greasewood-pickleweed; alkali bottomland	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	-----	-----	0-50	-----	-----	0-50	Proper management and stocking.
A6-Y1-W1 (60-20-20)	-----	-----	21,600	-----	-----	21,600	
A6-Y1-W1 (80-10-10)	-----	-----	1,400	-----	-----	1,400	
Subtotal	-----	-----	23,000	-----	-----	23,000	
3. Shadscale-grass; droughty desert uplands	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	100-350	50-150	10-70	100-350	50-150	10-70	Selective spraying, brush removal and seeding on selected sites, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, proper management and stocking.
A3-A6-S2	-----	-----	93,700	75,000	17,000	1,700	
A12-S2-D2	-----	-----	38,400	30,000	8,000	400	
B1-L1-B4-C4	-----	-----	700	500	200	-----	
B1-R5-L1 (60-30-10)	-----	-----	2,100	1,500	500	100	
B4-R1-L5	-----	-----	13,300	8,000	5,000	300	
B5-R6-L1	-----	-----	12,500	8,000	4,000	500	
B7-L6-R9	-----	-----	7,700	5,000	2,500	200	
L6-B1-S3	-----	-----	1,500	800	700	-----	
R9-L6-B7-S4	-----	-----	13,700	7,000	6,000	700	
R11-L1-B4	-----	-----	12,700	8,000	4,000	700	
S2-A3-D2	-----	-----	42,200	28,000	13,000	1,200	
S2-A7	-----	-----	18,100	12,000	6,000	100	
S2-A12-D2	-----	-----	16,100	12,000	4,000	100	
S2-D2	-----	-----	18,300	13,000	5,000	300	
S2-S6-A1	-----	-----	19,500	13,000	6,000	500	
S2-S6-A12	-----	-----	23,300	18,000	5,000	300	
S2-S7	-----	-----	42,200	30,000	11,000	1,200	
S2-S7-B2	-----	-----	6,300	4,000	2,000	300	
S2-S15	-----	-----	1,600	1,200	400	-----	
S2-S15-A2	-----	-----	2,700	2,000	700	-----	
S5-G1-B2	-----	-----	23,400	16,000	7,000	400	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
3. (Continued)	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
	100-350	50-150	10-70	100-350	50-150	10-70	
S5-B2	-----	-----	1,300	900	300	100	(See previous page.)
S6-A2	-----	-----	30,500	22,000	8,000	500	
S6-A2-B5	-----	-----	78,800	59,500	17,500	1,800	
S6-B5	-----	-----	2,500	1,800	700	-----	
S6-B5-A2	-----	-----	3,500	2,300	1,000	200	
S6-B5-R1-G1	-----	-----	8,600	6,000	2,300	300	
S9-L6-B10	-----	-----	14,500	10,000	4,000	500	
S10-G1-B9	-----	-----	15,800	10,500	4,500	800	
Subtotal	-----	-----	565,500	406,000	146,300	13,200	
4. Winterfat-budsage-big sage-grass; silty desert flats	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	150-400	50-200	20-150	150-400	50-200	20-150	
A3-A6-S2	-----	-----	2,500	2,000	500	-----	Proper management and stocking, erosion-proofing of roads, streambank and channel stabilization.
R9-L6-B7-S4	-----	-----	600	500	100	-----	
S2-A3-D2	-----	-----	2,500	2,000	500	-----	
S2-S7	-----	-----	700	600	100	-----	
S6-A2	-----	-----	5,000	4,000	1,000	-----	
S6-B5-A2	-----	-----	300	300	-----	-----	
Subtotal	-----	-----	11,600	9,400	2,200	-----	
5. Big sagebrush-grass; upland benches and terraces	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	250-600	100-450	20-150	250-600	100-450	20-150	Brush removal and seeding, selective spraying, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, intensify fire protection, proper management and stocking.
A3-A6-S2	-----	-----	9,900	8,000	1,500	400	
A11-S15	-----	2,800	15,600	15,000	2,800	600	
B1-L1-B4-C4	-----	3,800	19,500	19,000	4,000	300	
B4-R1-L5	-----	-----	7,300	5,000	2,000	300	
B5-R6-L1	-----	-----	3,000	2,000	1,000	-----	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
5. (Continued)	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
	250-600	100-450	20-150	250-600	100-450	20-150	
B7-L6-R9	-----	1,300	6,700	5,700	2,000	300	(See previous page.)
L6-B1-S3	-----	-----	23,800	18,500	5,000	300	
R9-L6-B7-S4	-----	-----	51,300	35,000	15,000	1,300	
R11-L1-B4	-----	4,700	18,100	18,000	4,500	300	
R12-B1-C1-L1	-----	-----	2,000	1,500	500	-----	
S2-A1	-----	-----	23,400	18,000	5,000	400	
S2-A2-G1	-----	-----	11,500	8,000	3,000	500	
S2-A7-B6	-----	4,500	22,600	22,500	4,000	600	
S2-B6	-----	2,000	32,200	24,000	8,000	2,200	
S2-B6-A11	-----	-----	29,200	21,000	7,000	1,200	
S2-A7	-----	-----	600	500	100	-----	
S2-S7-B2	-----	-----	17,500	13,000	4,000	500	
S2-S15	-----	-----	10,600	8,000	2,000	600	
S2-S15-A2	-----	-----	37,800	30,000	7,000	800	
S5-B2	-----	-----	12,300	9,000	3,000	300	
S6-A2-B5	-----	-----	9,200	7,000	2,000	200	
S6-B1-A12-G2	-----	3,500	7,800	9,000	2,000	300	
S6-B5	-----	-----	8,500	6,000	2,000	500	
S6-B5-A2	-----	1,600	50,800	38,000	12,000	2,400	
S6-B5-R1-G1	-----	-----	7,100	6,000	1,000	100	
S6-B6-L11	-----	2,000	37,000	30,000	8,000	1,000	
S8-S12-A11	2,500	-----	24,700	21,500	5,000	700	
S10-G1-B9	-----	200	11,300	9,000	2,200	300	
Subtotal 2/	2,500	26,400	511,300	408,200	115,600	16,400	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
6. Low sagebrush-grass; claypan benches	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	200-500	100-250	50-150	200-500	100-250	50-150	
B1-R5-L1 (60-30-10)	-----	4,100	3,300	6,000	1,000	400	Selective spraying, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, proper management and stocking.
B4-R1-L5	-----	3,500	39,900	35,500	6,500	1,400	
L6-B1-S3	-----	-----	37,600	27,000	9,600	1,000	
R6-L3-B5	-----	-----	300	200	100	-----	
R11-L1	-----	-----	1,700	1,100	600	-----	
R11-L1-B1	-----	8,300	9,000	15,000	2,000	300	
R11-L1-B4	-----	-----	1,200	900	300	-----	
S2-A1	-----	-----	1,500	1,200	300	-----	
S2-A7-B6	-----	-----	700	500	100	100	
S2-B6	-----	-----	4,600	3,000	1,000	600	
S2-S5	-----	-----	6,300	4,000	2,000	300	
S2-S7-B2	-----	-----	2,900	2,100	700	100	
S5-B2	-----	-----	6,200	5,000	1,000	200	
S6-B1-A12-G2	-----	6,100	2,200	7,800	400	100	
S6-B5	-----	-----	12,000	9,000	2,000	1,000	
S6-B5-R1-G1	-----	-----	4,900	3,100	1,100	700	
S6-B6-L11	-----	-----	600	400	100	100	
Subtotal 3/	-----	22,000	134,900	121,800	28,800	6,300	
7. Browse-aspen-grass; intermediate mountain slopes	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	300-650	150-350	50-200	300-650	150-350	50-200	
B1-R5-L1 (40-40-20)	-----	100	24,200	18,000	5,000	1,300	Streambank and channel stabilization, erosion-proofing of roads, beaver control, intensify fire protection, proper management and stocking.
B1-R5-L1 (60-30-10)	-----	3,600	21,000	21,300	3,000	300	
B4-L6-R7	-----	500	-----	500	-----	-----	
B4-R1-L5	-----	5,200	4,300	8,500	800	200	
B7-L6-R9	-----	500	12,900	10,000	3,000	400	
R1-B1-L1	-----	-----	10,200	7,500	2,500	200	
R1-L1-B1	-----	-----	13,800	10,000	3,400	400	
R11-L1	-----	10,900	45,900	43,000	12,000	1,800	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
7. (Continued)	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
	300-650	150-350	50-200	300-650	150-350	50-200	
R11-L1-B4	-----	4,700	14,900	16,000	3,000	600	(See previous page.)
R11-L1-B4-C4	-----	10,200	33,300	34,500	8,000	1,000	
R12-B1-C1-L12	-----	3,800	10,200	8,000	5,500	500	
S2-A1	-----	-----	29,100	21,000	7,000	1,100	
Subtotal	-----	39,500	219,800	198,300	53,200	7,800	
8. Pinyon-juniper-grass; shallow stony slopes	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	100-250	50-150	10-75	100-250	50-150	10-75	
B1-R1-L1	-----	-----	9,500	6,500	2,500	500	Removal of pinyon-juniper in small blocks on invaded livestock or big game range, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, intensify fire protection, proper management and stocking.
B1-R5-L1	-----	-----	14,200	7,500	5,500	1,200	
B4-L6-R7	-----	-----	16,800	9,000	6,400	1,400	
B4-R1-C4-L1	-----	-----	16,500	9,000	6,000	1,500	
B4-R1-L5	-----	1,800	22,000	16,000	6,000	1,800	
B7-L6-R9	-----	-----	15,700	11,000	3,000	1,700	
L2-R13-Z	-----	-----	800	500	200	100	
R6-L3-B5	-----	-----	15,100	5,500	7,500	2,100	
R11-L1	-----	1,800	7,900	7,500	1,200	1,000	
R11-L1-B1	-----	-----	54,300	38,000	13,000	3,300	
R11-L1-B1-C1	-----	-----	12,600	7,800	3,800	1,000	
R11-L1-B4	-----	6,800	66,000	49,000	20,000	3,800	
R11-L1-B4-C4	-----	-----	7,600	5,500	1,800	300	
R12-B1-C1-L12	-----	-----	3,100	2,000	800	300	
S2-S5	-----	-----	2,200	1,500	500	200	
S6-B5-R1-G1	-----	-----	5,900	3,500	1,900	500	
S6-B6-L11	-----	-----	4,300	2,800	1,200	300	
S9-L6-B10	-----	-----	500	300	100	100	
Subtotal 4/	-----	10,400	275,000	182,900	81,400	21,100	

Continued

Table 1. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Reese River Sub-Basin -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
9. Browse-aspen-conifer-grass; steep mountain slopes and basins	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	350-800	200-500	75-250	350-800	200-500	75-250	
B1-R5-L1	-----	700	-----	700	-----	-----	Fencing, streambank and channel stabilization, erosion-proofing of roads, contour trenching, gully plugs beaver control, intensify fire protection, proper management and stocking.
L3-R13-Z	-----	-----	27,200	20,000	6,000	1,200	
R1-L1-B1	-----	-----	2,300	1,700	500	100	
R11-L1	-----	1,000	1,500	1,800	600	100	
R11-L1-B1	-----	-----	1,700	1,200	500	-----	
R11-L1-B1-C1	-----	-----	7,900	5,000	1,600	1,300	
R11-L1-B4	-----	9,500	100	9,500	100	-----	
R11-L1-B4-C4	2,200	3,000	2,900	7,000	900	200	
Subtotal 5/	2,200	14,200	43,600	46,900	10,200	2,900	
Total	4,700	113,200	2,001,400	1,520,300	504,400	94,600	

1/ These figures indicate total annual forage production (dry weight), and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

These rates represent production variance from poor years to good years. At higher elevations within the site, with greater precipitation the rates would be higher, and conversely for lower elevations.

2/ Does not include 8,400 acres unsuitable (unsuitable range, or range which should not be grazed).

3/ Does not include 2,700 acres unsuitable (unsuitable range, or range which should not be grazed).

4/ Does not include 6,800 acres barren or inaccessible, and 72,600 acres unsuitable (unsuitable range, or range which should not be grazed).

5/ Does not include 6,200 acres barren or inaccessible, and 43,000 acres unsuitable (unsuitable range, or range which should not be grazed).

Source: Humboldt River Basin Field Party.

One small rod-square exclosure east of the Stone Cabin Ranger Station on upper Reese River, which has been protected from livestock use for approximately 40 years, indicates, by its high incidence of bitterbrush and Great Basin wildrye and small amount of big sagebrush, the potential improvement in vegetal cover contingent upon improved grazing management (see photograph 26). The cattle-tight, rabbit-proof and deer-proof exclosures on the bench west of the Ranger Station also illustrate the heavy inroads being made on the surrounding range forage and watershed cover, particularly the key browse, forb and grass species.

Heavy cutting of the pinyon stands in the Toiyabes and the Shoshone Range incident to the Reese River mining boom, from 1862 to approximately 1896, bared many of the steep, thin-soiled slopes to the ravages of sheet and gully erosion. The resultant site deterioration has inhibited or in some cases prevented the restablishment of the original pinyon cover. Junipers, cheatgrass, or worthless forbs and brush have usurped many of these pristine sites, and the watershed has suffered. It is interesting to note that the Austin newspaper in 1884 observed that cordwood and mine timbers were being hauled to Austin from timber stands more than 40 miles away.

At the time of the 1862-1896 Austin-upper Reese River mining activity, there was also a great lumber demand for building purposes. Most of this demand was satisfied by bringing in lumber from the pine forests of the eastern Sierra; however, this was extremely costly. For this reason many of the high altitude stands of limber pine around Arc Dome - toward the heads of Reese River, Sawmill and Little Sawmill Canyons - were harvested and sawed into rough lumber, known locally as "Reese River lumber". Although greatly inferior to the Sierra product, the local lumber's comparative cheapness resulted in a steady demand. As a result, much of these high watershed soils were exposed, and although a good second-growth stand has since come in, much topsoil loss has occurred through sheet erosion. The denudation also encouraged the establishment of well-developed gully systems at these drainage heads.

From the 1880's until after March 1907, the date when the Toiyabe Forest Reserve, now a portion of the national forest by that name, was set aside, much of the high watershed area in the Toiyabes and the Shoshone Range suffered severe loss of browse and herbaceous plant cover. This loss stemmed primarily from uncontrolled use by vast numbers of sheep belonging to nomadic outfits. The decimation of this type of plant cover also contributed to the previously discussed topsoil loss and gullying. Establishment of the present national forest, followed by the passage of the Taylor Grazing Act in 1934 and the setting up of the Division of Grazing - now the Bureau of Land Management - shortly thereafter, eventually eliminated the migrant sheep problem.

Extensive acreages of former semi-wet meadow and saline bottomland along all of Reese River have lost their ryegrass-bluegrass-sacaton-sedge understory through misuse and overuse. This started with the trail herds and heavy livestock use during the emigrant and Pony-Express-stage-freighting period, and continued after the establishment of the cattle industry in this part of Nevada in 1862. Great herds of Texas longhorns fed in these meadows, from 1862 until the disastrous winter of 1889-1890. As a sequel to this overuse and the resultant meadow desiccation by channel cutting, these once lush ryegrass meadows have largely disappeared. In the 1860's and early 1870's, Great Basin wildrye was reported to be so thick and high along the river from Silver Creek south to Reese River Butte that early settlers lived in fear of range fires each fall. Now, these meadows have largely disappeared, having been replaced by extensive stands of greasewood and rubber rabbitbrush, scattered willow and buffaloberry stringers along the main channels, and saltgrass on the more saline sites.

Photograph 26. - Rod-square fenced exclosure established by the U.S. Forest Service on upper Reese River approximately 40 years ago. This exclosure affords a glimpse of the former vegetal cover here, which is in marked contrast with present deteriorated vegetal cover conditions on the adjacent unfenced range.
FIELD PARTY PHOTO

Photograph 27. - Desiccation of winterfat-bud sage type by gullying of Gilbert Creek channel, upper Antelope Valley. This ground water loss has resulted in the invasion of big sagebrush, shadscale, and worthless forbs, all clearly evident in the foreground and middle distance of the photograph. FIELD PARTY PHOTO 6-770-12

From all indications there were at one time extensive winterfat-bud sage types present on the silty desert flats along upper and middle Reese River, in the Antelope basin, and in Carico Lake Basin. However, excessive and yearlong livestock use through the years has greatly reduced the acreage of these valuable forage species. Shadscale, big sagebrush, and worthless forbs have replaced or are replacing them (see photograph 27). Only a few relict areas still remain (see General Cover Types).

Phreatophytes

The phreatophytes of low economic value consist largely of greasewood, rabbitbrush, green Molly, seepweed, and Bassia. Greasewood is the most common, with rubber rabbitbrush occurring as the major phreatophyte on the sites higher upstream. The general occurrence and development of all these species in the sub-basin are fully discussed under General Cover Types, in preceding pages of this report. (See photographs 7 and 8.)

Under or between the greasewood and rabbitbrush can occasionally be found an understory of Great Basin wildrye, usually of low density, with varying admixtures of bottlebrush squirreltail, alkali sacaton, and saltgrass. Many worthless annuals, and the forb phreatophytes listed in the previous paragraph, also occur in the understory. These areas are uniformly in the low forage production class.

As noted in the discussion of general cover types, small willow and silver buffaloberry areas occur as thin stringers along the eroded main channel of upper Reese River, primarily from the Visbeek Ranch southward. (See tables 2 and 3.)

Timber Management

There are no commercial sawtimber stands in the sub-basin. Singleleaf pinyon pine and Utah juniper make up the major portion of the less-than-sawtimber size commercial stands. In the Toiyabe Range, above this pinyon-juniper belt, mountain mahogany, as noted in General Cover Types, grows in thick stands on the southern and western exposures of the steep slopes and high ridges at the drainage heads. Scattered limber pine stands are found on the north exposures at these higher elevations (see photograph 12). The Shoshones and the Cortez Range, being generally lower in elevation, have no significant amounts of any commercial timber, except for pinyon-juniper. Of these two, juniper predominates. In both ranges, the stands of aspen and cottonwood are not large enough to be of commercial significance.

On the national forest, pinyon pine-juniper in the Intermediate Zone is managed for Christmas tree and convertible product production on medium to deep soils where regeneration can be expected and erosion controlled to an acceptable minimum. Stands on shallow soils will be managed to maintain or improve soil conditions. After Regional Forester approval, pinyon-juniper may be controlled on medium to deep soils where these species have invaded or are invading livestock or big game range, with livestock or big game forage production being the key value. Such areas will not exceed 100 acre blocks.

Live mountain mahogany will not be cut commercially until satisfactory regeneration methods have been developed, and then only after the supply of dead material has been exhausted. Harvest priority then will be directed to overmature stands where browse is out of reach of big game.

Aspen is harvested only when cutting will enhance recreation or wildlife values; limber pine is not harvested.

Table 2. -- Phreatophyte acreage and annual ground water use, Reese River drainage, Reese River Sub-Basin 1/

Species	Height class	Density	Acreage cropland	Acreage range types 2/	Annual ground water use 2/ (feet)	Annual ground water use 2/ (acre-feet)
Willow	5-12'	.3-.7	-----	300	2.3	700
Rose	3-8'	.3-.7	-----	200	1.5	300
Black greasewood	3'+	.04-.08	-----	21,000	.3	6,300
Black greasewood	3'-	.04-.08	-----	18,000	.2	3,600
Rubber rabbitbrush	3'+	.04-.1	-----	13,000	.3	3,900
Saltgrass	----	.08-.12	-----	4,600	.5	2,300
Seepweed	----	.04-.09	-----	5,000	.5	2,500
Great Basin wildrye	----	.04-.7	-----	4,700	1.0	4,700
Alkali sacaton	----	.08-.12	-----	3,200	.5	1,600
Subtotal				70,000		25,900
Irrigated meadow hay and pasture 3/			2,300		.3	700
Wet meadow 3/			5,400		.5	2,700
Subtotal			7,700			3,400
Total			7,700	70,000		29,300

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

Table 3. -- Phreatophyte acreage and annual ground water use, Carico Lake Valley and Crescent Valley drainage, Reese River Sub-Basin 1/

Species	Height class	Density	Acreage cropland	Acreage range types 2/	Annual ground water use 2/ (feet)	Annual ground water use 2/ (acre-feet)
Black greasewood	3'+	.04	-----	2,000	.3	600
Black greasewood	3'-	.04-.06	-----	24,000	.2	4,800
Rubber rabbitbrush	3'+	.04-.06	-----	4,000	.3	1,200
Saltgrass	---	.04-.06	-----	9,400	.5	4,700
Alkali sacaton	---	.05-.06	-----	3,400	.5	1,700
Great Basin wildrye	---	.05-.06	-----	3,200	1.0	3,200
Subtotal				46,000		16,200
Wet meadow 3/			200		.5	100
Total			200	46,000		16,300

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

The Forest Service is continually looking for new markets, uses, and values for all commercial species, to the extent of at least defraying removal costs.

On the national land reserve, there have been a few juniper post sales in both the Reese River and the Crescent Valley-Carico Lake Valley portion of the sub-basin. The area is capable of producing more posts on a sustained yield basis than present demand consumes.

On the Battle Mountain District portion of the national land reserve, five pinyon Christmas tree sale areas have been set up, but to date no trees have been sold. There is a good potential for commercial Christmas tree sales on all these lands. However, the lack of access roads, and the present lack of markets for these trees, have hindered the further development of Christmas tree sales. At the present time, practically the only cutting of Christmas trees on national land reserve in the sub-basin is done on an individual free-use basis by residents of the Carlin and Battle Mountain areas.

In the sub-basin as a whole, including all classes of ownership, there is little or no collection of pinyon nuts on a commercial basis. The occurrence of years of good seed production are generally too uncertain, and accessible pinyon stands too scattered, to make it commercially profitable.

Natural timber stand regeneration, particularly in the limber pine stands on the national forest, is progressing fairly well without artificial regeneration. It is thought that with proper management and protection, this natural regeneration may suffice in helping to heal the damaged watershed conditions on these high mountain lands. At present, no satisfactory method of planting has been developed which would aid in regeneration of the Toiyabe and Shoshone pinyon pine stands.

Fire Protection

Range fires in the immediate past have caused widespread watershed damage in the sub-basin, and remain an omnipresent threat (see photograph 24). With deterioration or destruction of the original plant cover, whether brought about by fire or other watershed abuse, the vegetal types coming in increase the fire hazard by providing flash fuels. Fire on the upland slopes of the mountainous areas could be seriously damaging to the watershed areas.

Risks of fires caused by the rapidly increasing recreation and hunter use of the watershed lands will continue to mount. The significance of these water-yielding lands to the arid valleys below makes fire protection a factor of increasing importance. Prevention or prompt suppression of potentially disastrous range or timber fires is now and will continue to be an important facet of resource and watershed management.

RECREATION AND WILDLIFE

Recreation Developments

The Reese River Sub-Basin, particularly upper Reese River and its tributaries from Silver Creek southward, is rapidly growing in importance as an outdoor recreation area. Not only Nevada residents, principally from Reno and Las Vegas, but also residents from neighboring States, California in particular, are becoming more aware of the recreation potential here.

Photograph 28. - Primitive hunter camp, upper Reese River, in the vicinity of the Stone Cabin Ranger Station. With the exception of the U.S. Forest Service campground development on Big Creek, this type camp is typical of present recreation areas here. Within the next decade, the Forest Service plans to develop a large number of improved campground and recreation areas on this central Nevada portion of the Toiyabe National Forest, similar to the Big Creek facilities.
FIELD PARTY PHOTO

As the population buildup continues, and with improved roads and trails, the sub-basin's recreation potential will become even better known. More and more people will discover for themselves the sub-basin's lonely beauty and scenic grandeur; this is particularly true of the Toiyabe Mountains. With fuller recognition and develpement of the largely untapped recreation potentialities for camping, picnicking, hunting, fishing, wilderness travel, pine-nutting, and hobby-type recreation in general, recreation use is becoming one of the sub-basin's salient assets.

Within its boundaries, on both national forest and national land reserve lands, there are many points of historical significance. These are being increasingly sought out by tourists, historians, and hobbyists in general, from both within and without the State. Some were important during the covered wagon period of westward migration, some during the Pony Express, stagecoach, and freighting period, and some during the flowering of the Reese River mining boom, 1862-1896. There are far too many to enumerate here; a fairly complete list may be compiled through perusal of the section on settlement in this report.

<u>Toiyabe National Forest</u>

The Big Creek Forest Camp, in the Toiyabe Range, with seven family units, soon to be expanded to 12 units, is presently the only improved recreation facility on either the Austin or the Reese River Ranger Districts within the sub-basin. This campground is located on Big Creek, approximately 15 miles south of Austin, in the Travel Influence Zone of the Austin District's multiple use plan (see Forest Service Programs).

As previously noted, greatly augmented recreation use pressure during the next decade is anticipated for the Ranger Districts of the Toiyabe Division. To meet the pressure, during the next 10 years the Forest Service plans to concentrate a significant portion of its campground and recreation area development effort on this section of the Toiyabe National Forest. (See photograph 28.)

In planning for the multiple use of the national forest lands in the sub-basin to meet the public's needs to the year 2000, the Forest Service, in its 1962 National Forest Recreation Survey (NFRS) has inventoried 29 new camp, picnic, and organization sites on the Reese River (Fallon) Ranger District, with an approximate total of 650 family units. On the Austin Ranger District, the NFRS lists seven additional recreation sites to be developed, including an extension of the present Big Creek Forest Camp. (See table 9, Appendix I.)

National Land Reserve

At present, there are no camp and picnic areas or any other recreation developments on these lands. The Elko and Battle Mountain Districts of the Bureau of Land Management, in their 1961 recreation inventory report, and a 1963 updating of that report for this portion of the Humboldt, propose the construction of several camp and picnic areas and roadside developments. (See table 10, Appendix I.)

Wildlife

Deer and Other Big Game Hunting

The most important big game animal found in the Reese River Sub-Basin today is the mule deer, whose habitat is primarily confined to the major mountain ranges. Studies indicate the large deer herds of today are the result of changes in the plant community brought about through overuse by domestic livestock, lumber and cord wood cutting, and other forms of destructive resource exploitation incident to the mining boom period. Many old newspaper articles written in the 1860's and '70's mention the lush grasslands found in the Reese River drainage.

Antelope and bighorn sheep were much more common in the early days than deer. Deer were scarce through the 1920's, but had increased noticeably by the early 1930's. By the late 1930's and early 1940's deer numbers in the Toiyabe Range had reached fantastic proportions, and the Toiyabe Range was designated a deer problem area by the Forest Service. In cooperation with the Forest Service, Lander and Nye County sportsmen held the first special antlerless deer hunts in Nevada (1941). As ranges changed from predominantly perennial grass types to browse-annual grass-weed types, conditions became more favorable for deer and less so for antelope and bighorn sheep, which have all but disappeared. At present there is one small band of desert bighorn, in the Arc Dome area at the head of Reese River in the Toiyabe Range.

Extent of Mule Deer Summer Ranges and Harvest Data for Major Ranges in the Reese River Drainage System

Mountain range	Estimated square miles of deer summer range: National Forest	National Land Reserve	Total	Approximate harvest: Five-year average
Toiyabe	456	94	550	355
Shoshone Mountains	127	0	127	81
Shoshone Range	0	137	137	197
Fish Creek Mountains	0	64	64	22
Galena Range	0	30	30	28

In recent years, deer numbers have steadily declined as continued over-grazing, combined with key plant species mortality, have reduced range carrying capacity for deer. Deer populations can be expected to fluctuate periodically, depending upon range conditions. However, it should be recognized that the best deer ranges are transitional, and that good range conservation practices which take advantage of natural plant succession will ultimately result in many browse-aspect ranges being replaced with perennial grasses. This will of course reduce range carrying capacity for deer.

Fishing

While the trout streams in this area are small, they are well stocked by the Nevada Fish and Game Commission, and usually provide excellent fishing. Because of past land abuse and resultant severe channel erosion and sedimentation, several formerly good fishing streams no longer support a fish population. (See the following tabulation.)

List of Fishable Streams

Mountain range	Stream	Estimated miles on national forest lands	Estimated miles on national land reserve	Total fishable miles
Toiyabe	Reese River	13	11	24
Toiyabe	Little Sawmill	2	0	2
Toiyabe	Big Sawmill	3	0	3
Toiyabe	Illinois	3	0	3
Toiyabe	Stewart	3	0	3
Toiyabe	Clear	2	0	2
Toiyabe	Mohawk	1	0	1
Toiyabe	Marysville	2	0	2
Toiyabe	San Juan	2	0	2
Toiyabe	Big Creek	1	1	2
Fish Creek Mountains	Cottonwood	0	1	1
Fish Creek Mountains	Fish Creek	0	1	1
Shoshone Range	Mill Creek	0	12	12
Shoshone Range	Lewis	0	1	1
Shoshone Range	Crum	0	1	1
Total		32	28	60

Streams Which Were Formerly Fishable but no Longer Support Fish Because of Erosion Damage

Mountain range	Stream	National Forest land	National land reserve
Toiyabe	Indian Creek	x	
Toiyabe	Washington	x	
Toiyabe	Italian		x
Toiyabe	Boone		x
Toiyabe	Iowa		x
Toiyabe	Hall		x

Small Game

Chukar partridge, sage grouse, cottontail rabbit, California Valley quail and blue grouse are all found in the Reese River drainage; however, only chukar, sage grouse and cottontail are of major importance as game.

During the last 10 years the chukar has become increasingly the most important game bird as populations have reached high levels during good moisture years. While sage grouse are very popular with Nevada sportsmen, populations of this bird have not reached the peaks that they once did, and as a result, the annual season is short - usually one or two days.

The cottontail and pygmy rabbit, while abundant in many areas, is not as popular with Nevada sportsmen as with sportsmen from other States.

PROGRAMS OTHER THAN PROJECT-TYPE DEVELOPMENTS AVAILABLE FOR THE IMPROVEMENT OF WATER AND RELATED LAND RESOURCES

Lands in the sub-basin can be treated or can receive aid for treatment under existing U.S. Department of Agriculture and other Federal and State programs. The Forest Service and Bureau of Land Management are responsible for forest, fish and wildlife habitats, range, recreation, and watershed development on the Federal lands they administer. The owners of private land can receive aid for water and related land resources development by means of various programs under the U.S. Department of Agriculture.

Technical Assistance and Cost-Sharing Under Public Law 46

Under the provisions of Public Law 46 the Soil Conservation Service furnishes technical assistance through Soil Conservation Districts, and the Agricultural Conservation Program of the Agricultural Stabilization Conservation Service provides cost-sharing. Under these programs, assistance in developing coordinated conservation plans and in applying conservation measures may be furnished for farms and ranches. These plans provide for surveys, land use adjustments, erosion control, water conservation, irrigation, drainage, flood prevention, and recreation development. Solution to the sub-basin problems on private land may be arrived at in part by these programs.

The Soil Conservation Service has the responsibility for leadership in the National Cooperative Soil Survey. With the assistance of several cooperative groups and agencies in this work, soils maps and survey reports will be published in the regular schedule of soil survey publications of the U.S. Department of Agriculture.

Agricultural Water Management

There are many ways of improving water management on individual ranches throughout the sub-basin. Some of the treatments for various types of problems are listed below.

Problems	Suggested treatment
1. Limited water supply	a. Develop irrigation water by drainage of seeps, springs and high water table. b. Control phreatophytic plant growth. c. Construct overnight storage reservoirs to better utilize small flows for irrigation. d. Clear stream channels of all obstructions and install diversions with adequate control features. e. Development of irrigation water wells and irrigation storage reservoirs where investigation reveals their feasibility. f. Line or seal ditches through reaches of excessive seepage loss (see photograph 29). g. Stop applying water to fields after soil reaches field capacity.
2. Saline soils.	a. Install drains to lower water table. b. Use only good quality water for irrigation to reduce salt concentration in the soil. c. Use proper soil and water management.

Photograph 29. - Concrete diversion dam, Trout Creek, lower Reese River Valley. The stilling basin for an irrigation pipeline is seen at the left. S.C.S. PHOTO 6-754-7

Problems	Suggested treatment
3. High water table.	a. Install suitable drainage. b. Improve creek channels for drainage outlets to reduce frequent flooding of bottomland. c. Check the possibility for pump drainage. This may increase water supply for irrigation. d. Land smoothing to remove low ponding areas. e. Line and seal ditches. f. Stop applying water to fields after soil reaches field capacity.
4. Low water use efficiency.	a. Level or smooth land for even water application. b. Reorganize water distribution and irrigation systems. c. Line ditches through highly permeable soils. d. Stop applying water after soil reaches field capacity. e. Plant high-yielding crops suitable for conditions, to reduce irrigated acreage now needed for hay production.

Problems	Suggested treatment
5. Inadequate water distribution systems.	a. Install diversions with adequate control features. b. Reorganize water distribution systems. c. Use lined ditches or pipe lines through highly permeable soils. d. Construct necessary control structures in ditches.

Vegetal Improvement

Stream bank cutting and channel erosion as well as watershed erosion on privately owned land indicate the need for action to reverse the trend toward meadow desiccation and land deterioration. Each of the following solutions would contribute in some measure to the improvement of plant species and cover, which in turn will help reduce this erosion.

Problems	Suggested treatment
Irrigated lands	
1. Low yields.	a. Establish higher-yielding forage crops suitable to the soil and water conditions, for hay and pasture. b. Use irrigation methods that will permit more efficient use of water and create an environment for higher producing forage plants. c. Develop a fertilization program. d. Do not feed on wet fields.
Nonirrigated lands	
1. Range condition static or on decline.	a. Practice rotation-deferred grazing. b. Use bottomland pasture to supplement available range. c. Control low economic value plant growth to increase forage production. d. Develop a program of seeding and rehabilitating the rangelands. e. Establish proper use practices. f. Fence, to enable better grazing control and proper range use. g. Improve salting and water distribution for better grazing control.

Watershed Protection and Erosion Control

The intermingled private range land on the north, as well as the valley upland range land throughout the sub-basin, is generally in poor condition. The sparse cover in this area is conducive to active erosion. The treatment required to reverse the condition trend in this area would include range seeding and spraying of sagebrush on selected sites, along with good management and proper use.

Channel and gully erosion are very active throughout the sub-basin. Permanent type control structures and land treatment measures are needed to protect the existing meadows and restore desiccated meadowlands. In addition, bank sloping, seeding of banks, and channel fencing along selected areas will help heal the erosion.

Possibilities for Water Salvage

Ground water use by all phreatophytic plants is estimated to be about 45,600 acre-feet annually (see tables 2 and 3). This includes 3,500 acre-feet used by Great Basin wildrye and other wet meadow species harvested as hay or pasture in the valley bottoms. The acreage of alfalfa grown in the valley bottoms is comparatively small and therefore is not included.

Phreatophytic plants of low economic value such as willows, greasewood, rabbitbrush, wild rose, seepweed, and saltgrass, use an estimated 30,900 acre-feet of water annually. More effort should be made to control or replace these water-consuming plants by spraying, deep drainage, and blading. A large portion of this water could be salvaged by the control or replacement of most of these water-wasting plants.

Forest Service Programs

National Forest Land

Following passage of the Multiple Use-Sustained Yield Act (Public Law 86-517) of June 12, 1960, the Nevada Subregion Multiple Use Management Guide was approved. In this Guide, five Management Zones - Crest, Intermediate, Valley Front, Travel Influence, Water Influence, and one Special Zone - have been delineated for coordination of uses. This is not restrictive zoning, but zoning to fully develop all resources in harmony with each other.

Management direction and management guides are set up for each zone. Within this framework, multiple use plans have been developed for each Ranger District on the Toiyabe National Forest. In each Ranger District Multiple Use Plan, management decisions are made to coordinate uses of resources on individual areas of national forest land within the Humboldt River Basin.

In all cases, the guiding precept of the law provides for "the management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people...without impairment of the productivity of the land".

The Forest Service is cooperating in the National Soil Survey by surveying and mapping national forest lands. The surveys will be completed as rapidly as time and funds permit.

The regular programs of the Forest Service will provide for many of the watershed land treatment and structural measures needed on the Toiyabe National Forest, to the extent that currently available funds permit. For the purposes of this report, however, the land treatment and structural measures recommended for the national forest lands of the Fallon (Reese River) Ranger District lying south of the Cottonwood Creek drainage in the Toiyabes, and Riley Creek in the Shoshones, are grouped together in the proposed

Upper Reese Watershed discussion. These lands are all located within that proposed project. (See Watershed Protection and Improvement, Reese River Watershed, Appendix I.)

On the remaining portions of the Fallon Ranger District, and all the Reese River area of the Austin Ranger District, none of the needed watershed improvement measures, of themselves, can be fitted to a project-type development. For that reason, they are included here.

Watershed Treatment Measures

1. Make a detailed analysis of watershed problems in Pony and Marshall Canyons, Austin's vital municipal watershed area.

2. Eliminate cattle use from these two drainages as soon as the Big Creek and Bade Flat (Simpson Park) Revegetation Projects become fully established and ready for grazing use. (The cattle from Pony Canyon would use Bade Flat; those from Marshall Canyon, Big Creek)

3. Fence the Big Creek-Birch Creek Cattle Allotments, to separate the use. The fence would be extended northward and westward, to furnish protection to the Austin watershed.

   The allotment will be divided into six management units, and a deferred-rotation plan of use instituted. (The Big Creek-Birch Creek revegetation project, when fully operational, is designed to remove all cattle use from the high country at the heads of all the Toiyabe drainages on the Austin Ranger District.)

4. Reduce fire risks and intensify other fire presuppression work.

5. Immediate emergency rehabilitation measures on the Austin and other watershed lands in the event of wildfire.

6. Elimination of all livestock trespass.

7. Prepare permits or agreements with Austin Township and Lander County for the Austin watershed, to enhance the cooperative aspects of the management and protection of this key watershed area.

8. Maintain deer numbers, and those of other wildlife - beaver in particular - in balance with their food supply.

9. Limit off-road cross-country motorized vehicular travel to specified areas.

10. Intensive management of the smaller watersheds on National Forest land will improve water yield. Measures taken to increase water yield should be integrated with the downstream needs.

Bureau of Land Management Programs

National Land Reserve

The Bureau of Land Management is responsible for the administration and management of approximately 72 percent of the acreage in Reese River Sub-Basin. Highlights of the Bureau's range management program include the proper use and improvement of the national land reserve. In addition, the Bureau is responsible for fire presuppression and control activities on the intermingled public and private lands they administer.

Adjudication of grazing privileges in this sub-basin has been completed on less than one-fourth the area. After adjudication is completed, and individual allotments fenced, management plans will be developed for each allotment to insure proper use of the forage resources.

The soil and moisture program is integrated with the grazing program and consists of stabilization and rehabilitation projects necessary to conserve soil, water, and closely related resources. The work also includes improvement of vegetation through natural revegetation, control of undesirable forage plants, seeding of more desirable plants, as well as soil surveys and hydrological studies on pilot watershed areas. The weed control program is designed to arrest the invasion and spreading of weed species which are poisonous or mechanically injurious to domestic livestock, or which threaten the agricultural economy of the area. Another facet of range and watershed management requiring immediate attention is the erosion-proofing or revegetation and retirement of old, abandoned, or low-standard roads, the contributory source of a considerable amount of washing, gullying, and sedimentation. It is planned that the construction of all new roads will be done to proper standards and with adequate drainage.

Land classification, fire protection, and recreation are important phases of the Bureau of Land Management program. The long range land program includes the encouragement of land exchanges, in order to establish a more desirable land pattern, particularly on the higher watershed lands. The Bureau's proposed recreation development program is briefly outlined in table 10, Appendix I.

The national land reserve in the Reese River Sub-Basin, along with intermingled private lands, provides an important winter range for deer. Deer from the Toiyabe, Shoshone and Cortez ranges, as well as from the mountains north of the Humboldt, migrate into this area during the winter months.

Bureau of Indian Affairs Programs

Indian Reservation Lands

The Bureau of Indian Affairs is responsible for administration and management of approximately 4,700 acres of the Yomba Indian Reservation in this sub-basin. Their improvement program includes the protection, proper use, and development of these lands.

Plans for cropland improvement consist of ditch reorganization, water control structures, and a limited amount of land smoothing, which are felt necessary for the conservation of soil and water. The improvement of range lands, which are used by the tribe members as community allotments, will be accomplished by natural revegetation and some range seeding.

Fire Protection

Two Federal agencies are charged with the responsibility for fire prevention and suppression within the sub-basin. Personnel of the Austin and Fallon (Reese River) Ranger Districts of the Toiyabe National Forest are responsible for the protection of the national forest lands within their respective districts. The Elko and Battle Mountain Districts of the Bureau of Land Management share the fire protection job on the national land reserve.

The following factors have helped or are needed to keep abreast of the increasing fire risks and hazards:

1. Introduction of new techniques, including more widespread and aggressive fire protection, and improved fire prevention and patrol measures.

2. More and better suppression equipment. The agencies concerned have established air tanker bases at Elko and Minden, to be used on the suppression of wild fires.

3. Recognition of high hazard areas from the study of past fire occurrence maps and fuel type maps, as well as keeping posted on new cheatgrass area buildups. Where possible, convert from high-hazard species to lower fire danger vegetal cover.

4. Intensified and more diligent inspection and hazard elimination along the Southern Pacific and Western Pacific rights-of-way. Insist that railroads adhere closely to the Nevada fire laws with respect to fireproofing of diesel locomotives. Trucking firms and contractors using internal-combustion equipment should also be checked for compliance with this section of the fire laws.

5. Use of improved national fire danger rating systems.

6. Improved fire detection and radio communications.

7. Inclusion of cooperator ranch crews in Federal control organizations.

8. Hazard reduction in connection with road maintenance and recreation site development.

WATERSHEDS WITH OPPORTUNITIES FOR PROJECT-TYPE DEVELOPMENT

The Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, as amended) authorizes the Secretary of Agriculture to give technical and financial help to local organizations in planning and carrying out works of improvement in watershed or sub-watershed areas of 250,000 acres or less. These projects are for: (1) flood prevention; (2) the agricultural phases of water management; (3) public recreational developments; and (4) other purposes, such as municipal and industrial water supplies, and improvement for fish and wildlife.

Project works of improvement include land treatment measures and individual structures having not more than 5,000 acre-feet of flood-water detention capacity, or not more than 25,000 acre-feet of capacity for all purposes.

Watershed projects provide a means for coordinated scheduling and installation of needed improvement on public and private lands which otherwise would only be accomplished over a longer period of time.

The problems in at least one watershed are such that they can best be handled on a project basis. Projects in this watershed would provide for watershed protection, flood control, reduce erosion, supply late irrigation water, and possible recreation development.

Upper Reese Watershed

The Upper Reese River watershed is in the southern end of the sub-basin - entirely in Nye County. In general, it includes Reese River and all its tributaries south from Washington Creek, and consists of an area of approximately 250,000 acres.

Thirty-seven percent of land in the watershed area is national land reserve, 59 percent national forest, two percent privately owned, and two percent Indian Reservation land. Elevation of the watershed ranges from approximately 6,000 to over 11,000 feet. Average annual precipitation varies from eight to 20 inches. Average growing season (28 degrees F) is estimated to be 130 days.

Annual water balance studies for an 80 percent frequency (chance) show the primary source of water for this project watershed to be the Toiyabe Range, within the Toiyabe National Forest. Runoff from snowmelt furnishes most of the irrigation water; approximately 8,300 acre-feet. From this total an estimated 2,400 acre-feet are used by the irrigated crops, and the remainder is either used by phreatophytes or discharged down Reese River.

There are at least 3,400 acres of cropland in the watershed area. Of this, about 2,000 acres are inside the Yomba Indian Reservation. Primary crops grown are native meadow hay and pasture. Presently, the private land is divided among an estimated five owners. In addition, there are seven Indian operators on the Yomba Indian Reservation.

General vegetal aspect of the Reese River Watershed is big sagebrush-grass, with extensive areas of low sagebrush toward the south end, and on the high, open ridges and slopes of the Toiyabe Range, above the pinyon-juniper belt. Widely dispersed bitterbrush is found throughout the big sagebrush and low sagebrush as part of the overstory. Scattered stands of limber pine are found on the high north exposures, curlleaf mahogany on the south slopes, and cottonwood, aspen, and birch on the moister sites, and along creek bottoms. Many of the once common stands of aspen along the upper reaches of Reese River and its tributaries have been removed by overlarge beaver colonies.

The bottomlands consist of native pasture and meadow lands, with their characteristic grasses and sedges, and the usual fringe phreatophyte stands of greasewood and rubber rabbitbrush.

Willow and some cottonwood in thin stringers line the upper Reese River channel, from the upper narrows to its headwaters. The formerly scattered small meadows along

these reaches have largely disappeared, through channel desiccation and livestock overuse, and have been replaced by big sagebrush and rubber rabbitbrush.

Approximately 33 percent of the watershed area is either barren, inaccessible, or unsuitable for grazing. Of the remaining range land, 95 percent is in the low, and five percent is in the medium, forage production classes.

There are no irrigation wells or reservoirs in this watershed area. Irrigation water is usually depleted by the end of June.

Agricultural irrigation water problems prevalent are: (1) poor seasonal distribution of water; (2) high water table; (3) water supply used on low-yielding forage crops; (4) lack of adequate water control structures; and (5) low water use efficiency.

The wet-mantle flood of 1910, a cloudburst in July 1952, and a series of summer storms in July and August 1953 and August 1963 are the only records of flood damage in this watershed area. However, other floods undoubtedly have contributed to the large width and depth of the Reese River channel. In many places the channel is 50 feet wide and from 15 to 20 feet deep.

There are three sites in the watershed where topographic characteristics are suitable for storing irrigation and flood waters, and providing recreation developments. It is proposed that two earth reservoir dams, of sufficient capacity, be constructed on the sites which are considered to best meet the needs of the participants in the project.

There are no developed recreation areas in the watershed, and the Bureau of Land Management has no present plans for providing any. However, the Forest Service has inventoried approximately 30 sites for eventual planned development by the year 2000.

A preliminary evaluation of the works of improvement proposed for this watershed is sufficiently favorable to warrant a more detailed study, to determine the feasibility of a project watershed.

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APPENDIX I

Pertinent elaborative material of value to the general reader, for his reference and guidance in the use of the sub-basin report.

CONTENTS

INITIATION OF ACTION
for
PROJECT - TYPE DEVELOPMENT

Accomplishing the Improvements, Public Law 566

The development of project operations would need to be initiated by a local sponsoring organization representing the landowners and operators. The sponsoring organization could initiate such action by submitting an application for watershed planning assistance to the Director of the State Department of Conservation and Natural Resources.

Under the provisions of the Watershed Protection Act, and the operations procedures as developed by the U.S. Department of Agriculture, a local sponsoring organization would provide needed land rights for structural improvements, and assume the responsibility for contracting the structural work and for its subsequent operation and maintenance.

The landowners would have responsibility for the installation of land treatment measures on the privately owned lands. Cost-sharing and credit assistance could be made available by the U.S. Department of Agriculture for such work.

The Forest Service and the Bureau of Land Management would assume responsibility for the installation of land treatment measures on the Federal lands they administer, which would be accomplished with the usual participation in costs by the range users.

Funds appropriated under the Watershed Protection Act can be made available to defray the cost of construction of the structural improvements for the reduction of floodwater and sediment damages, and to share in the construction cost of structural improvements for irrigation, drainage, fish and wildlife, and other recreation features. These funds may also be used to provide cost-sharing assistance to local sponsors for the acquisition of land, easement and rights-of-way needed for public recreational developments.

UPPER REESE WATERSHED

Physical Features of the Watershed

Location

The Upper Reese Watershed is in the southern end of the sub-basin, in Nye County. In general, it includes Reese River and all its drainages south from Washington Creek, and covers an area of about 250,000 acres.

Geology

The oldest consolidated rocks exposed include quartzite, slate, schist, limestone, grit, conglomerate, sandstone, chert, greenstone (largely andesitic volcanic rocks), felsite (includes rhyolitic volcanic rocks), bedded tuff, and a possibly intrusive felsitic rock with flow banding. Other older largely consolidated rocks in the Ione-Grantsville area include limestone, dolomite, slate, argillite, conglomerate, shale, and sandstone. Intrusive igneous rocks exposed in the Toiyabe and Shoshone Ranges include granodiorite, quartz monzonite, diorite, granite, aplite, and alaskite. These rocks are overlain by volcanic rocks, including andesite and quartz latite.

The flood plain of Reese River is a relatively narrow strip bordered on each side by at least one prominent terrace. The present flood plain may be developed on stream alluvium that was deposited in the past following at least one cycle of down-cutting. Reese River's present channel is entrenched as much as 20 feet below the flood plain in some locations.

Soils

The soils in the higher elevations are shallow to moderately deep, well drained, and are medium textured; some stony or gravelly medium textured soils are included. On the upland benches and terraces the soils are generally shallow to deep, moderately well to well drained, and are medium textured. There are some areas where the soil is moderately deep over a cemented pan. In the valley bottoms the soils are deep, imperfect to well drained, and medium to coarse textured; salt and alkali concentrations are slight.

Vegetation

The general vegetal aspect of the Upper Reese watershed is big sagebrush-grass, with extensive areas of low sagebrush-grass being found toward the southern extremity, and on the high open ridges and slopes of the Toiyabe Range above the pinyon-juniper belt. The Reese River valley bottom, from the watershed's northern extremity to the upper narrows of the Reese inside the Toiyabe National Forest, represents the total hay-producing area. However, the deeply gullied main channel of the river has desiccated much of this former meadow land. As a result, phreatophytic rabbitbrush and greasewood have invaded, with rabbitbrush being found on the lower bottomland areas, and greasewood fringing the bottomland. Thin stringers of willow and buffaloberry appear intermittently along each side of the main channel gully.

Pinyon-juniper occupies the slopes of the Toiyabe and Shoshone Ranges above the valley uplands, extending upward to the steep mountain slopes site. Pinyon predominates in the Toiyabe Range, while juniper gives the type its aspect in the Shoshones.

In the Toiyabes, the steep mountain slopes site is extensive, being comprised of low sagebrush-grass types on the open slopes and ridge tops, with large areas of mountain mahogany on the south and west exposures of Arc Dome and the other high peaks along the main Toiyabe summit. Widely dispersed bitterbrush is found throughout the big sagebrush and low sagebrush as part of the overstory.

Rather extensive areas of limber pine occur on the north exposures, and on the highest plateaus and benches. The limber pine, mahogany, and low sage types are interspersed with talus and rock outcrops; much of the acreages of these types within the steep mountain slopes site are either inaccessible to livestock use or should not be grazed.

Cottonwood is found at the lower reaches of most of the Toiyabe canyon bottoms, giving way to aspen and scattered willow or willow fringe in their higher reaches. The largest aspen type in the sub-basin is found in the basin of Stewart Creek. Aspen once covered much of the upper Reese River bottomland within the national forest, particularly in Sawmill Canyon and the canyons of the upper Reese above the Forest Service stone cabin at Upper Corral Flat. However, they have been or are now being removed by over-large beaver colonies, and represent only a small percentage of their pristine acreage in the upper Reese headwaters.

One unusual aspen area is located at the mouth of Little Jet Canyon, where it empties into upper Reese. The aspen here appear to be hybridized between aspen (Populus tremuloides) and Lombardy poplar (Populus nigra, var. Italica). So far as is known, this cross has not been observed elsewhere. (See photograph 30.)

Photograph 30. - Aspens of unusual growth form, mouth of Little Jet Canyon, toward the head of Reese River, on the Toiyabe National Forest. The aspen, known to occur only at this location, appear to be hybridized between the usual species and Lombardy poplar. FIELD PARTY PHOTO

Willow in thin stringers and scattered cottonwood groves line the Reese River channel from the upper narrows to its headwaters. However, the small meadows formerly scattered along these upper reaches have largely disappeared through channel desiccation and livestock overuse, and have been replaced by big sagebrush or rubber rabbitbrush.

Climate

There are four precipitation recording stations in and adjacent to the watershed. They are located at Austin (71 years), Yomba School (eight years), Ione Station on Reese River (10 years), and on Kingston Summit (seven years). There are also five cooperative snow survey courses which are in or close to the watershed; three on Big Creek and two on Reese River: Upper and Lower Corral. The only temperature recording station is at nearby Austin.

Records from the above stations and the water balance studies indicate the average annual precipitation varies from 12 to 20 inches in the Toiyabe Range (elevation 7,000 to over 11,000 feet), and from 12 to 15 inches in the Shoshone Range (elevation 7,000 to over 10,000 feet). On the irrigated bottomland the precipitation is estimated to be between eight and 10 inches.

Average length of growing season (28 degrees F) for the irrigated land is estimated to be 130 days. The length of the average frost-free period will decrease at higher elevations.

Land Status and Use

The land status and use breakdown is as follows:

		Land use					
Land Status	Acres	Range land		Irrigated land		Barren unsuitable or inaccessible	
		Acres	%	Acres	%	Acres	%
National Forest	179,000	97,900	59	------	---	81,100	100
National Land Reserve	60,500	60,500	37	------	---	------	---
Indian Reservation	4,700	2,700	2	2,000	59	------	---
Private	4,800	3,400	2	1,400	41	------	---
Total	249,000	164,500	100	3,400	100	81,100	100

The private land is divided among an estimated five land owners. The 1,400 acres of privately owned irrigated land are used to produce hay and pasture for the winter feeding of cattle grazing on the intermingled private and Federal rangeland.

The Yomba Indian Reservation lands are used for the production of crops and range forage. At the present time the 2,000 acres of crop land are divided among seven individual ranches, and the range land is used in common by the ranch holders.

The Federal and private range lands are used for spring-fall and summer range for domestic livestock and big game, as year-long habitat for big game and other wildlife, and as a watershed area.

Water Supply and Use

Surface Water

The Toiyabe Range is the primary source of water for this project watershed, contributing between 75 and 80 percent of its gross water yield. Runoff from snowmelt furnishes most of the irrigation water (see Annual Water Balance Studies, Appendix 1).

Water balance studies made by the Field Party indicate that the gross water yield (available water prior to agricultural and phreatophytic use) for an 80 percent frequency (chance) year (expected to be equalled or exceeded eight out of 10 years) would be approximately 8,500 acre-feet. From this total an estimated 2,400 acre-feet are used by irrigated crops and pasture, 1,500 acre-feet are used by phreatophytes, and 4,600 acre-feet discharge down Reese River. In addition there are an unknown number of stock-water developments (ponds and springs) which use some water.

Ground Water

At the present time there are no irrigation wells. There are a few low-capacity wells for stock water and farmstead use. There have been no known ground water investigations made except on an individual site basis.

Water Needs for Recreation Areas and Special Use Sites

Currently, there are no developed recreation areas or special use sites in the watershed. The Battle Mountain District of the Bureau of Land Management has no plans for future recreation developments here. To meet an anticipated greatly expanded recreation use of the national forest lands in the watershed portion of its Reese River (Fallon) Ranger District, the Forest Service, in its 1962 National Forest Recreation Survey, has inventoried approximately 30 campgrounds, picnic, and organization sites, with an approximate total of 650 family units. Assuming a water need of an estimated 23,000 gallons of water per day for a 120-day season, the anticipated annual water requirement for the season of use would be about nine acre-feet, when the sites are fully developed.

Watershed Problems

Agricultural Water Management

Irrigation water is generally in short supply before the end of June, except for a few favorably situated ranches. During the period of runoff, April through June, most of the native hay and pasture lands are being continuously irrigated (see figure 2). There are no storage reservoirs in the watershed, and few significant improvements have been made toward the betterment of water management.

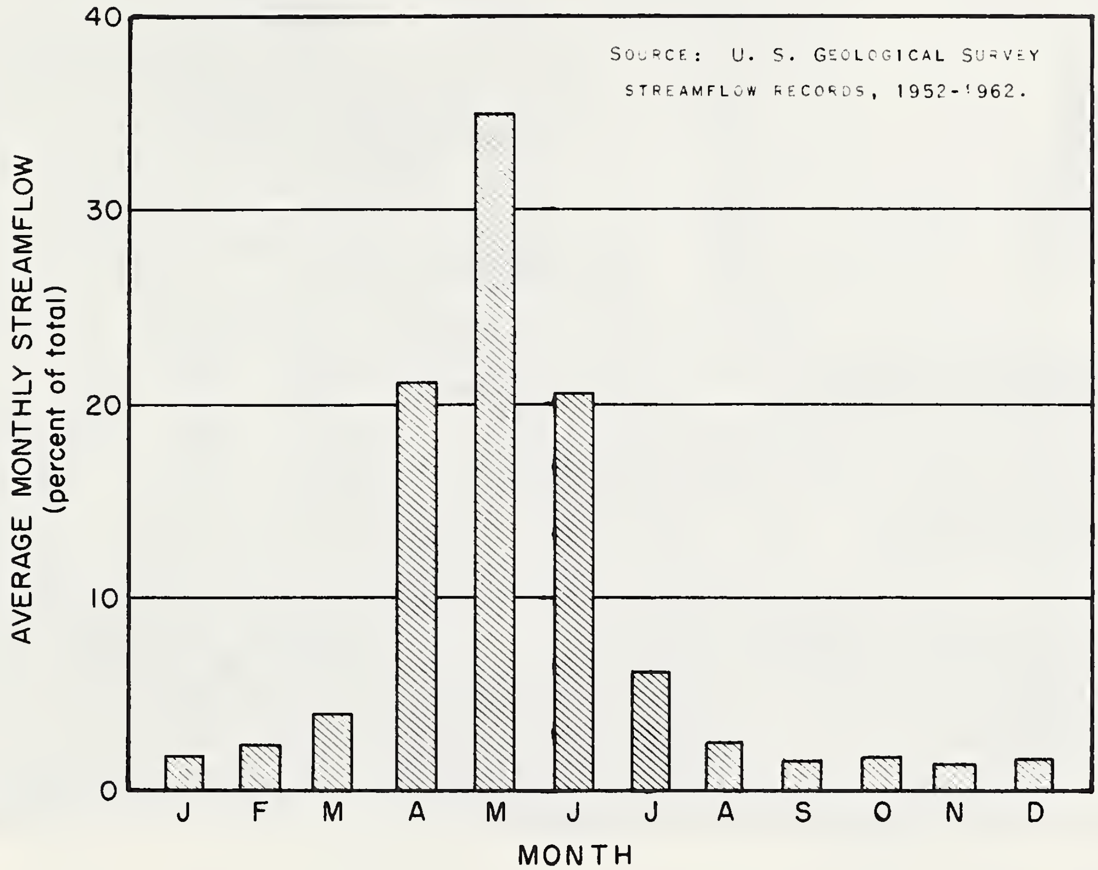
Agricultural water management problems which were found to be prevalent include:

1. Poor seasonal water distribution.

2. High water table.

3. Water supply used to produce low-yielding crops.

Figure 2. -- Annual streamflow distribution, Upper Reese River Ione Gage



4. Lack of adequate water control structures.

5. Low water use efficiency.

Flood Water, Erosion and Sediment Damage

The wet-mantle flood of 1910, a cloudburst in July 1952, and a series of summer storms in July and August 1953 are the only records of flood damage in the watershed. However, evidence of damage in the form of erosion and debris can be found throughout the area (see photograph 31). The several floods that have been recorded as damaging Austin no doubt caused some flooding in the south end of Reese River Valley. These flood years included 1870, 1878, and 1884.

Reese River channel in many places is 50 feet wide and cut 15 to 20 feet deep; channel cutting is still very active. Most of the tributary streams also show signs of erosion and debris deposition.

Photograph 31. - Dry-mantle flood debris deposited at the mouth of a small tributary of upper Reese River, in the vicinity of the Stone Cabin Ranger Station. Depleted range and watershed cover in these Toiyabe Range highlands has been directly responsible for many similar mud-rock freshets emanating from a number of Reese River tributaries. FIELD PARTY PHOTO

Vegetation - Kind and Condition

Phreatophytes

In the proposed watershed area, extensive acreages of former semi-wet meadow and saline bottomland along Reese River have lost their ryegrass-bluegrass-sacaton-sedge understory through heavy grazing overuse. The wide expanse of waving Great Basin wildrye, as high as a horse's withers, according to old verbal and written accounts, has largely disappeared. They have been replaced by extensive stands of rubber rabbitbrush and greasewood, scattered willow and buffaloberry stringers along the main channels, and rather widespread saltgrass areas on the more saline sites.

Depletion of the original perennial grass cover, coupled with flooding in 1910 and subsequent flood periods, encouraged formation of the wide, deeply eroded and still active channel head cut along upper Reese River. In turn, this head cut has led to large-scale meadow desiccation and the invasion of phreatophytes. These phreatophyte areas are uniformly in the low forage production class. (See table 4.)

Table 4. -- Phreatophyte acreage and annual ground water use, Upper Reese Watershed 1/

Species	Height class	Density	Acreage cropland	Acreage range types 2/	Annual ground water use 2/ (feet)	Annual ground water use 2/ (acre-feet)
Willow	5-12'	.4	-----	300	2.3	700
Rose	3-8'	.4	-----	200	1.5	300
Black greasewood	3'+	.07-.08	-----	600	.3	200
Rubber rabbitbrush	3'+	.07-.08	-----	500	.3	100
Saltgrass	----	.07-.08	-----	100	.5	---
Great Basin wildrye	----	.07-.4	-----	200	1.0	200
Subtotal				1,900		1,500
Irrigated meadow hay and pasture 3/			1,000		.3	300
Wet meadow 3/			400		.5	200
Subtotal			1,400			500
Total			1,400	1,900		2,000

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

Table 5. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Upper Reese Watershed

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
1. Rabbitbrush-greasewood-grass; saline bottomlands	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	850-1,500	200-900	20-300	850-1,500	200-900	20-300	Brush removal by blading, streambank and channel stabilization, erosion-proofing of roads, proper management and stocking.
H1-A1	-----	700	8,200	5,000	3,500	400	
S2-A7-B6	-----	---	800	600	200	---	
Subtotal	-----	700	9,000	5,600	3,700	400	
2. Big sagebrush-grass; upland benches and terraces	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	250-600	100-450	20-150	250-600	100-450	20-150	Brush removal and seeding, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, intensify fire protection, proper management and stocking.
S2-A1	-----	-----	300	200	100	-----	
S2-A7-B6	-----	4,500	20,300	12,500	7,300	5,000	
S2-B6	-----	2,000	32,200	24,000	8,000	2,200	
S5-B2	-----	-----	1,300	800	300	200	
Subtotal 2/	-----	6,500	54,100	37,500	15,700	7,400	
3. Low sagebrush-grass; claypan benches	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	200-500	100-250	50-150	200-500	100-250	50-150	Selective spraying, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, proper management and stocking.
R6-L3-B5	-----	-----	300	200	100	---	
S2-A7-B6	-----	-----	700	500	100	100	
S2-B6	-----	-----	4,600	3,000	1,000	600	
S2-S5	-----	-----	6,300	4,000	2,000	300	
Subtotal 3/	-----	-----	11,900	7,700	3,200	1,000	
4. Browse-aspen-grass; intermediate mountain slopes	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	300-650	150-350	50-200	300-650	150-350	50-200	Streambank and channel stabilization, erosion-proofing of roads, beaver control, intensify fire protection, proper management and stocking.
B4-L6-R7	-----	500	-----	500	-----	-----	
Subtotal	-----	500	-----	500	-----	-----	

Continued

Table 5. -- Acreage of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Upper Reese Watershed -- Continued

Vegetal type and site	Present annual forage plant production classes (acres)			Potential annual forage plant production classes (acres)			Treatment needed to reach potential
5. Pinyon-juniper-grass; shallow stony slopes	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	100-250	50-150	10-75	100-250	50-150	10-75	Removal of pinyon-juniper in small blocks on invaded livestock or big game range, fencing, stockwater development, streambank and channel stabilization, erosion-proofing of roads, intensify fire protection, proper management and stocking.
B4-L6-R7	-----	-----	16,800	9,000	6,400	1,400	
R6-L3-B5	-----	-----	15,100	5,500	7,500	2,100	
R11-L1-B1	-----	-----	800	700	100	-----	
R11-L1-B1-C1	-----	-----	11,300	7,500	3,000	800	
S2-S5	-----	-----	2,200	1,500	500	200	
Subtotal 4/	-----	-----	46,200	24,200	17,500	4,500	
6. Browse-aspen-conifer-grass; steep mountain slopes and basins	Production classes (pounds per acre) 1/			Production classes (pounds per acre) 1/			
Soil associations	350-800	200-500	75-250	350-800	200-500	75-250	Fencing, streambank and channel stabilization, erosion-proofing of roads, contour trenching, gully plugs, beaver control, intensify fire protection, proper management and stocking.
L2-R13-Z	-----	-----	-----	-----	-----	-----	
L3-R13-Z	-----	-----	27,200	20,000	6,000	1,200	
R11-L1-B1	-----	-----	1,700	1,200	500	-----	
R11-L1-B1-C1	-----	-----	6,800	4,000	1,500	1,300	
Subtotal 5/	-----	-----	35,700	25,200	8,000	2,500	
Total	-----	7,700	156,900	100,700	48,100	15,800	

1/ These figures indicate total annual forage production (dry weight), and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

These rates represent production variance from poor years to good years. At higher elevations within the site, with greater precipitation the rates would be higher, and conversely for lower elevations.

2/ Does not include 2,100 acres unsuitable (unsuitable range, or range which should not be grazed).

3/ Does not include 500 acres unsuitable (unsuitable range, or range which should not be grazed).

4/ Does not include 3,500 acres barren or inaccessible, and 36,600 acres unsuitable (unsuitable range, or range which should not be grazed).

5/ Does not include 2,800 acres barren or inaccessible, and 37,200 acres unsuitable (unsuitable range, or range which should not be grazed).

Source: Humboldt River Basin Field Party.

Range Forage Production

Table 5 furnishes information on the range forage production acreage, present and potential, for the Upper Reese Watershed. At present there are no areas of range other than those in the low forage production class suitable or accessible for grazing, except for a relatively limited acreage of medium forage production range in the aspen type (intermediate mountain slopes site) in Stewart Creek. Also in the medium forage production class are most of the acreage of the Forest Service and Bureau of Land Management Barret and Becker seedings, and the Bureau of Land Management seedings on lower Stewart Creek between Cottonwood and Tierney Creeks.

There are some areas of medium forage production on the high benchlands around Arc Dome Peak, and in the low sage-grass types in the highlands of the Toiyabe Range. However, because of steep slopes, unstable soil and vegetal conditions, and general inaccessibility or unsuitability of the area for livestock use, these more or less relict areas cannot be considered as producing available forage.

Practically all the meadows along the stream bottomlands in both the Toiyabes and Shoshones are in the low forage production class, being depleted and desiccated by the gullies which have developed in almost every stream bottom. This is particularly true in the Shoshone canyons, and along Washington, Tierney, and the short, steep drainages emptying into the headwaters of Reese River, around Arc Dome.

Opportunities for Development

Agricultural Water Management

Structural Measures

It is proposed that two reservoir dams be constructed across Reese River to store irrigation and flood water and provide for recreation development. There are three dam sites which could be used. The first is about four and one-half miles up Reese River above the confluence of Reese with Indian Creek. This is a narrow site, in rock, but the slope of the valley is steep and would require an estimated 110-foot dam to hold 1,400 acre-feet of water. In addition, about five miles of road would have to be built in order to utilize this facility. This reservoir would provide only a limited amount of flood protection.

The second dam site is about one and one-half miles below the confluence of Reese River and Indian Creek. It is estimated that a dam 56 feet high and 1,700 feet long would form a reservoir with a 3,000 acre-feet capacity. There are two farms above this reservoir with about 200 acres of irrigated land which would still have to depend on the perennial flow of Reese River for their water supply.

The third site is about two and one-half miles below the Yomba Indian School. A dam at this site about 35 feet high and 3,500 feet long would form a reservoir with a capacity of approximately 3,700 acre-feet.

The reservoir water, as well as water diverted from streamflow, would be apportioned by the participants in such a way that all existing rights were protected. It would be necessary to clear the Reese River channel below the dams of all obstructions so that water in excess of water rights stored in the reservoirs could flow freely down stream.

Land Treatment Measures

There are an estimated 3,500 acres of irrigable land in the watershed. During an 80 percent frequency (chance) year (expected to be equaled or exceeded eight out of 10 years) about 2,400 acres are irrigated.

For maximum production, most of the irrigated land would require land smoothing or leveling, and revised irrigation systems. There would also be a need for about 100 acres of drainage, 24 miles of supply ditches, four diversions, and the necessary lateral ditches, headgates, drops, turnouts, etc. After all improvements have been installed, the irrigable lands would have to be planted to improved forage crops for hay and pasture.

Watershed Protection and Improvement

Watershed deterioration and the accompanying reduction in range forage production has not only damaged the watershed's hydrologic characteristics, but has also imperiled the livestock industry itself. The following measures are considered to be the minimum treatment necessary to improve watershed conditions and increase forage production:

1. Install channel and streambank stabilization on approximately 90 miles of poor condition (Class 3) stream channel, and do the necessary fencing to protect this stabilization work (see Forest Service Region Four Channel Condition Classification Criteria, Appendix I). The Bureau of Land Management plans to construct three gradient-control structures across the main Reese channel on national land reserve lands below the Forest Service Reese River Ranger Station.

   This channel stabilization is needed not only along the full length of Reese River within the project area, but also for all its tributaries from both the Toiyabe and Shoshone Ranges. The Shoshone tributaries in particular are in urgent need of channel treatment. (See photograph 32.)

Photograph 32. - Channel cutting and pond washout, lower Indian Creek, in upper Reese River Valley. Denuded watershed cover conditions at the headwaters and tributaries of this stream have caused this channel headcut to advance between one and two miles within the past three years. SCS PHOTO 6-770-7

2. Install gully control structures and bleeder-type gully plugs at selected sites in the drainage heads of Washington, Stewart, Big and Little Sawmill, the small drainage west of Wrango Canyon in upper Reese River, and the headwaters of Reese River itself.

3. Eliminate livestock use on the steep, thinly vegetated slopes, high basins, and snowbank areas around Arc Dome and north from there along the Reese River face of the Toiyabe crest.

4. Adjust livestock numbers on the national forest to the available feed on range suitable for their use, as indicated by the range allotment analysis data now being developed. Complete the allotment adjudication program on the national land reserve.

5. In connection with item four, construct the necessary distribution fencing and approximately 30 new water developments.

6. During the administrative process of solving the grazing problems enumerated in items three and four, prepare a comprehensive hydrologic and watershed analysis of the national forest lands. From this a complete watershed rehabilitation program can be initiated on these lands.

7. Eliminate all livestock trespass; principally horse trespass is involved.

8. Work with the Nevada Fish and Game Commission to bring deer herd numbers in balance with forage production on the summer range around Arc Dome and northward from there in the Toiyabe Range.

9. Control beaver colonies threatening aspen stands. This is urgent, not only from an erosion control standpoint, but also to protect the recreation and aesthetic values of the hard-to-replace and scanty aspen stands, particularly toward the head of Reese River, on Stewart Creek, and other Toiyabe Range tributaries. (See photograph 33.)

10. Close the steep, eroding slopes and basins along the Toiyabe Crest Trail at the heads of the two forks of Washington Creek to livestock use, and install land treatment measures (contour trenching, gully plugging, and seeding) on approximately 900 acres. (See photograph 34.)

11. Treat all roads, in use or abandoned, to prevent or stop erosion. At least 17 miles of road are in need of treatment on all lands within the watershed. Of particular note are short roads up the Shoshone canyon bottoms, lower portions of the old Ophir Wash road, Washington and San Juan Canyon roads, and the poorly located four-wheel drive road from the Peavine drainage into upper Reese River at the Stone Cabin Ranger Station. This road should be reconstructed to a suitable standard, or better yet, retired completely.

12. Construct approximately 30 miles of allotment and unit management fence on both national forest and national land reserve lands. Where feasible, institute deferred-rotation grazing on these units.

Photograph 33. - Channel cutting and aspen stand depletion brought on by beaver colony activity and the subsequent washout of beaver dams. Upper Reese River, approximately one mile above the Stone Cabin Ranger Station, Toiyabe National Forest. FIELD PARTY PHOTO

Photograph 34. - Steep, eroding basin at the head of the south fork of Washington Creek, Toiyabe National Forest. The rills and small gullies, originally formed by the dry-mantle flood of July 1952, have subsequently lengthened and amplified. The Forest Service Toiyabe Crest Trail may be seen crossing the main channel in the middle distance. FIELD PARTY PHOTO

Photograph 35. - Spring development and stock-watering tank, national land reserve, Crescent Valley. S.C.S. PHOTO 6-634-12

13. Develop approximately 30 springs and seeps, wells, and ponds on these lands. (See photograph 35.)

14. Vegetal improvement by sagebrush control and range seeding on selected sites covering an estimated 4,000 acres of upland bench and terrace and claypan bench which at present are in the low forage production class.

15. Remove brush overstory by blading on about 2,000 acres of saline bottomland. By so doing, the presently thin understory of wildrye and associated perennial grasses will have the opportunity to again become dominant over much of this site.

16. Control big sagebrush and low sagebrush by selective spraying on approximately 4,000 acres of suitable range on national forest and national land reserve, to thicken the perennial grass understory.

    Note: The implementation of items 14, 15, and 16 will aid the development of items 3, 4, and 6 by enabling the transferral of livestock removed from unsuitable high-altitude ranges to these rehabilitated areas. The present Forest Service seeded or selectively sprayed areas at Dry Canyon, Big Creek, and Reid's Canyon have proven the practicality of these measures.

17. To insure the success of items 15 and 16, the present large population of rabbits and small rodents must be reduced to a minimal figure, avoiding these high population peaks so destructive to forage.

18. Range improvement through juniper control by chaining, blading or cabling. Any pinon removal will be in accordance with the timber management policies of the land management agencies involved.

Benefits Expected

Agricultural Water Management

The proposed reservoirs could provide a full-season irrigation water supply for about 2,500 to 3,000 acres of land planted to improved species for hay and pasture. The acreage and ownership of the cropland receiving benefits of the water stored would be determined in accordance with the needs and desires of the participants.

The structures would reduce the acreage of irrigated land being flooded each spring, permit the development of a more stable irrigation cropping program, permit a higher quality hay to be grown, be conducive to obtaining greater forage yields, reduce the acreage needed for hay production, and make higher irrigation efficiency possible. In addition, there would be some erosion control in the Reese River channel above and below the reservoirs. It would also be possible to increase the size of these structures so as to include some storage for recreation developments.

Watershed Protection and Improvement

The land treatment and structural measures would result in better protection for the watershed, reduce erosion, improve the range forage production, protect existing meadows, restore desiccated meadowlands, and reduce management problems. These benefits are reflected in terms of potential range forage improvement in table 7. It is estimated that the acreage of range land in the fairly high forage production class can be increased from none, at present, to over two-thirds of the useable range land area. There would be over a fourfold increase in terms of average pounds of useable forage produced, from the estimated present yield of 5,600,000 pounds to 23,400,000 pounds.

Conclusion

A preliminary evaluation of the proposed works of improvement is sufficiently favorable to warrant a more detailed study, to determine the feasibility of a watershed project.

SOILS DESCRIPTION

The generalized soil survey of the Reese River Sub-Basin shows the location and distribution of different kinds of soils by associations of Great Soil Groups. Each Great Soil Group includes a number of soils with similar internal development. Great Soil Groups mapped in the survey include:

Alluvial Soils (Symbol: A)

These are the soils that consist of essentially recent stream-laid deposits: alluvial fans, floodplains, terraces and basins. They have essentially no profile development, but a little organic matter may have accumulated. They are usually deep, stratified, variable with regard to drainage class, and occur under many different climates.

Brown Soils (Symbol: B)

These are the soils which have dark brownish A horizons about six inches thick, textural B horizons 10 to 15 inches thick, and calcareous parent material of variable thickness. Some of these soils have cemented calcium carbonate layers in the C horizon and some may have the C horizon resting on bedrock. They are usually moderately deep to deep, well drained, and occur under a cool semi-arid climate with an average precipitation of 10 to 14 inches. Most of the Brown Soils in the Reese River Sub-Basin occur at elevations above 5,000 feet, in the uplands.

Chestnut Soils (Symbol: C)

These soils have dark grayish brown to very dark grayish brown A horizons about six to eight inches thick, textural B horizons 10 to 15 inches thick, and parent material that may or may not be calcareous. These soils usually have darker A horizons, more organic matter, and have been more strongly leached than have the Brown Soils. The parent material may or may not rest on bedrock. They are usually moderately deep to deep, well drained, and occur in a cool semi-arid climate with an average precipitation of about 14 to 18 inches. Most of the Chestnut Soils in the Reese River Sub-Basin occur at elevations above 5,500 feet, in the uplands.

Calcisols (Symbol: G)

These soils occur on highly calcareous parent material in the arid and semi-arid regions. They have developed where leaching is limited, but have formed under good to excessive drainage conditions. They include soils in which the calcium carbonate has accumulated to form a prominent Cca on Dca horizon near the lower depth of wetting. They have a light gray-brown A or A1 horizon, about 10 to 15 inches thick, which becomes lighter colored with depth. They are moderately deep, well drained, and occur with an average annual precipitation of about eight to 12 inches at elevations below 7,000 feet.

Desert Soils (Symbol: D)

These are well to imperfectly drained soils in a cool arid climate. They have a thin light-colored A horizon (less than six inches) that is neutral to mildly alkaline, low in organic matter, with platy structure and frequently vesicular porosity. The B horizon (six to 14 inches) usually contains more clay, and is as dark or darker than the A, is neutral to strongly alkaline, and may be calcareous. A layer of calcium-carbonate

accumulation, that may be cemented, occurs in or below the B horizon at a depth of one to three feet. They are moderately deep, medium and gravelly medium textured and occur in a four to eight inch precipitation zone.

Humic Gley Soils (Symbol: H)

These are the dark brown or black meadow soils that grade into lighter colored or rust-mottled grayish soil at depths of one to two feet. They are imperfectly to poorly drained, usually with seasonal fluctuating high water table, and occur along stream floodplains where they are subject to overflow. They occur in a cool semi-arid climate, and are found in the Reese River Sub-Basin at elevations mostly below 6,000 feet.

Lithosols (Symbol: L)

These soils have an incomplete profile, or no clearly expressed morphology. They are shallow (less than 10 to 15 inches), and consist of freshly and imperfectly weathered masses of hard rock or hard rock fragments, and are largely confined to steeply sloping lands. In the higher rainfall areas of the sub-basin, some of these soils may have dark A horizons. They are usually excessively drained.

Regosols (Symbol: R)

These are soils which consist of deep unconsolidated deposits, in which few or no clearly expressed soil characteristics have developed. They are largely confined to colluvial accumulations on steep mountain slopes. Under eight to 10 inches of rainfall the Regosols may have only a weakly developed A horizon, while in higher rainfall areas they may have well developed dark A horizons six to 14 inches or more thick. In mountainous areas these soils may be underlain by bedrock 15 to 20 inches below the soil surface.

Sierozems (Symbol: S)

These are soils with a pale grayish or light brownish surface and textural B horizons closely related in color to the surface soil. They are usually calcareous in the B horizon, and frequently also in the surface soil. They quite often have a cemented calcium carbonate hardpan at shallow to moderate depths below the B horizon. The B horizon in the Sierozem Soils in this sub-basin is usually weakly developed and difficult to identify. In mountainous areas the Sierozems may be underlain by bedrock at moderate depths. These soils are found in a semi-arid cool climate, with an average annual precipitation of about eight to 10 inches, and mostly at elevations below 6,000 feet.

Solonchak Soils (Symbol: W)

These are saline, poorly to very poorly drained soils that are high in soluble salts at or near the surface. The A horizon is thin (less than four inches), light colored, and low in organic matter. They have no clearly expressed soil layers, and are usually associated with high water table. They are moderately deep to deep, medium and moderately fine textured and occur in a five to eight inch precipitation zone.

Solonetz (Symbol: Y)

These are imperfectly drained soils with a very few inches of light grayish or brownish surface soil underlain by a hard columnar fine-textured horizon that is high in exchangeable sodium. They occur on floodplains, terraces, and some alluvial fans,

usually as small areas associated with saline-alkali Alluvial Soils, Humic Gley Soils, and Calcium Carbonate Solonchaks.

Rockland (Symbol: Z)

These are essentially nonsoil areas, consisting of hard rock and hard rock fragments of granite, limestone and lava formations, which are extremely steep and inaccessible to livestock. They occur as outcrops, bluffs and cliffs with some talus areas below. Little or no weathering has taken place for soil formation. Vegetation on these areas is limited to natural fractures in the rock or small areas of deposited soil material.

Mapping Units

Mapping units on the generalized soil survey map of the Reese River Sub-Basin are associations of phases of Great Soil Groups that reflect characteristics of soils significant to use and management. Each mapping unit symbol includes the designation of approximate composition for each Great Soil Group that comprises the association.

Example: $\frac{\text{L1-C1-R1}}{\text{60-20-20}}$

SOILS TABLES

The following tables, 6 and 7, show the general soil characteristics and the interpretations for each Great Soil Group phase which was mapped in the sub-basin.

Table 6. -- Soil characteristics, Reese River Sub-Basin

Soil Phase	Depth	Texture: Surface	Texture: Subsoil	Slope range %	Erosion	Salt & alkali	Drainage	Remarks
A1	Deep	Coarse to medium	Medium to moderately fine	2-8	Slight	None	Well to mod. well	10% blow-sand deposition
A2	Deep	Medium and gravelly medium	Medium	2-15	Slight 10% mod.	None	Well	25% stony soils, seedable
A3	Deep	Medium	Medium	2-4	Slight 5% mod.	Slight	Well to mod. well	
A4	Deep	Medium	Medium	0-2	Slight	Slight	Imperfect	Overflowed
A5	Deep	Medium	Medium	0-2	Slight	None to Slight	Moderately well to well	20% seedable 10% overflowed Some gullying
A6	Deep	Medium to moderately fine	Medium to moderately fine	0-2	Slight	Moderate to strong	Imperfect to poor	
A7	Shallow to moderately deep	Medium to gravelly medium	Gravelly medium and medium	0-4	Slight 5% mod.	None	Somewhat excessive	Small areas suited to seeding
A11	Deep	Medium	Medium to moderately fine	2-8	Slight 15% mod.	None	Well	Seedable
A12	Deep	Medium	Medium to moderately fine	0-2	Slight	None to slight	Imperfect	Small areas of range
A13	Deep	Medium to moderately fine	Medium to moderately fine	0-2	Slight	Moderate to strong	Imperfect to mod. well	Small areas of cropland
A14	Deep	Medium	Medium	0-2	Slight	None to slight	Moderately well to well	Occasional overflow, 10% moderately saline and alkali
B1	Moderately deep to deep	Medium	Medium and moderately fine	30-50	Slight 15% mod.	None	Well	Hill creep

Continued

Table 6. -- Soil characteristics, Reese River Sub-Basin -- Continued

Soil Phase	Depth	Texture: Surface	Texture: Subsoil	Slope range %	Erosion	Salt & alkali	Drainage	Remarks
B2	Moderately deep to deep	Medium	Medium and moderately fine	4-15	Slight 5% mod.	None	Well	Small areas cropland seedable
B4	Deep	Stony medium and moderately fine	Moderately fine and fine	20-40	Slight 10% mod.	None	Well	5% chestnut 5% Sierozem
B5	Moderately deep to deep over bedrock	Medium	Moderately fine and fine	10-30	Slight 10% mod.	None	Well	15% stony medium 25% seedable
B6	Moderately deep over hardpan	Medium	Fine	3-10	Slight 5% sev.	None	Well	10% stony soils 60% seedable
B7	Moderately deep to deep	Moderately coarse	Moderately fine	10-30	Moderate 10% sev.	None	Well	
B9	Deep	Medium	Fine	3-10	Slight	None	Well, 5% imperfectly	80% seedable
B10	Moderately deep	Medium stony	Fine over hardpan	10-30	Slight 5% mod.	None	Well	
C1	Moderately deep to deep	Stony medium and medium	Medium to moderately fine	30-50	Slight	None	Well	
C4	Deep	Medium	Moderately fine to fine	16-50	Slight 5% mod.	None	Well	20% stony soils
D2	Moderately deep over gravels	Medium and gravelly medium	Medium and gravelly medium	0-4	Slight	None	Well	
G1	Moderately deep over alkali soluable hardpan	Medium and gravelly medium	Medium and gravelly medium	3-10	Slight 20% mod. 10% sev.	None	Well	10% stony soils 40% seedable

Continued

Table 6. -- Soil characteristics, Reese River Sub-Basin -- Continued

Soil Phase	Depth	Texture: Surface	Texture: Subsoil	Slope range %	Erosion	Salt & alkali	Drainage	Remarks
G2	Moderately deep	Medium and gravelly medium	Medium and gravelly medium	20-40	Slight 20% mod.	None	Well	10% stony soils
H1	Deep	Medium	Medium	0-2	Slight	Slight	Imperfect	Overflowed
H2	Deep	Medium	Medium	0-2	Slight	None	Imperfect to poor	
H6	Deep	Medium and moderately fine	Medium and moderately fine	0-2	Slight	Slight to mod.	Imperfect to poor	Overflowed
L1	Shallow over bedrock	Stony and rocky medium		50-70	Slight 20% mod.	None	Excessive	10% rock outcrop
L2	Shallow over bedrock	Stony and rocky medium to coarse		50-70	Slight 20% mod.	None	Excessive	10% rock outcrop
L3	Shallow over bedrock	Stony and rocky medium		30-50	Slight 15% mod.	None	Excessive	10% rock outcrop
L5	Shallow over bedrock	Very gravelly stony moderately coarse		30-60	Moderate 10% sev.	None	Excessive	10% rockland
L6	Shallow over bedrock	Stony and gravelly medium		20-30	Slight 10% mod.	None	Excessive	10% rockland
L11	Shallow over bedrock	Stony and gravelly medium		10-30	Slight 10% mod.	None	Excessive	10% rockland
L12	Shallow over bedrock	Stony medium		16-30	Slight 5% mod.	None	Somewhat excessive	
R1	Moderately deep to deep	Stony and gravelly medium	Stony and gravelly medium	30-60	Slight 15% mod.	None	Somewhat excessive	
R5	Moderately deep to deep	Stony and gravelly medium	Medium	30-50	Slight 15% mod.	None	Somewhat excessive	
R6	Moderately deep to deep	Stony and gravelly medium	Medium	15-30	Slight 50% mod.	None	Well	

Continued

Table 6. -- Soil characteristics, Reese River Sub-Basin -- Continued

Soil Phase	Depth	Texture: Surface	Texture: Subsoil	Slope range %	Erosion	Salt & alkali	Drainage	Remarks
R7	Moderately deep to deep	Stony and gravelly medium	Medium	30-50	Slight 15% mod.	None	Well	
R9	Moderately deep to deep	Stony and gravelly medium	Medium	8-15	Slight 10% mod.	None	Well	5% rock outcrop
R11	Deep	Stony medium	Medium	40-60	Slight 10% mod.	None	Somewhat excessive	10% rock outcrop and very stony
R13	Moderately deep over bedrock	Stony medium	Stony medium	30-60	Moderate 10% sev.	None	Somewhat excessive	10% rockland
S2	Shallow to moderately deep	Medium and grav-elly medium	Medium	2-8	Slight 15% mod.	None	Well	
S3	Moderately deep to deep	Stony medium	Medium	15-30	Slight 15% mod.	None	Well	
S4	Moderately deep to deep	Medium	Medium	2-15	Moderate gullying	None	Well	20% stony soils
S5	Moderately deep to deep	Medium and grav-elly medium	Medium	8-15	Moderate gullying 20% sev.	None	Well	20% stony soils
S6	Shallow to moderately deep	Medium	Medium	8-15	Moderate gullying	Slight	Well	15% stony soils
S7	Moderately deep to deep	Medium and mod-erately coarse	Medium and mod-erately coarse	2-8	Slight 15% mod.	None	Well	15% stony soils
S8	Moderately deep	Gravelly medium	Gravelly medium	20-40	Moderate	None	Well	10% stony soils

Continued

Table 6. -- Soil characteristics, Reese River Sub-Basin -- Continued

Soil Phase	Depth	Texture: Surface	Texture: Subsoil	Slope range %	Erosion	Salt & alkali	Drainage	Remarks
S9	Moderately deep	Medium	Medium	10-30	Slight	None	Well	10% moderately deep gravelly medium Sierozem, 10% deep Sierozem
S10	Moderately deep over hardpan	Medium	Moderately fine	10-30	Slight 15% mod.	None	Well	50% seedable
S12	Moderately deep over hardpan	Medium to moderately coarse	Moderately fine	10-30	Moderate	None	Well	50% seedable
S15	Deep	Medium	Medium	3-10	Moderate 10% sev.	None	Well	75% seedable
W1	Moderately deep to deep	Medium and moderately fine	Medium and moderately fine	0-2	Slight 20% mod.	Strong	Poor to very poor	Overflowed
Y1	Deep	Medium to moderately fine	Moderately fine to fine	0-3	Slight 5% sev.	Moderate to strong	Imperfect to mod. well	
Z	Rockland	-----	-----	---	---	----	-----	

Source: Humboldt River Basin Field Party.

Table 7. -- Interpreted soil characteristics, Reese River Sub-Basin

Soil Phase	Precip. zone (inches)	Erosion hazard	AWHC [1/] (inches)	Soil Hydro-logic Group	Capa-bility subclass	Major land use	Dominant vegetation
A1	6-10	Slight	12	C	VIIs	Range	Big sage-grass
A2	6-10	Slight	8	B	VIc	Range	Big sage-grass
A3	6-10	Slight to moderate	10	C	VIIc	Range	Shadscale-budsage, squirreltail
A4	6-10	Slight	10	B	IIIw	Irrigated crops	Alfalfa-small grain
A5	6-10	Slight	9	C	IIw VIc	Irrigated crops and range	Shadscale-budsage-greasewood-grass
A6	6-10	Slight	12	D	VIIs	Range	Greasewood-saltgrass, rabbit-brush-saltgrass
A7	6-10	Moderate	3	B	VIIs	Range	Big sage-grass
A11	8-12	Moderate	12	B	VIc	Range	Big sage-grass, rabbitbrush-Sandberg bluegrass
A12	6-12	Slight	12	B	IIw	Cropland	Big sage-greasewood, rabbit-brush, grass
A13	6-8	Slight	12	D	IVw VIIs	Range	Greasewood-saltgrass
A14	6-8	Slight	10	B	IIw VIc	Irrigated crops and range	Big sage-grass, rabbitbrush-grass
B1	6-20	Moderate	4	C	VIIe	Range	Big sage-grass, pinyon-juniper-grass
B2	6-10	Moderate	6	C	VIc	Range	Big sage-grass
B4	6-20	Slight	8	C	VIIs	Range	Big sage-grass, pinyon-juniper-grass
B5	6-12	Slight	6	C	VIIs	Range	Big sage-grass
B6	8-12	Slight	6	C	VIs	Range	Big sage-grass, juniper-grass

Continued

Table 7. -- Interpreted soil characteristics, Reese River Sub-Basin

Soil Phase	Precip. zone (inches)	Erosion hazard	AWHC 1/ (inches)	Soil Hydrologic Group	Capability subclass	Major land use	Dominant vegetation
B7	8-12	Severe	6	C	VIIs	Range	Big sage-grass
B9	8-10	Moderate	8	C	VIIs	Range	Big sage-grass
B10	8-10	Slight	5	D	VIIs	Range	Low sage-grass, big sage-grass
C1	6-20	Moderate	6	C	VIIe	Range	Big sage-bitterbrush-grass
C4	8-20	Slight	8	C	VIIe	Range	Big sage-grass
D2	6-10	Slight	4	D	VII	Range	Shadscale-budsage
G1	6-10	Moderate	5	D	VIc	Range	Big sage-grass
G2	10-12	Slight	5	D	VIIe	Range	Big sage-grass, juniper-grass
H1	8-10	Slight	12	B	IIw	Meadow hayland and pasture	Meadow grass
H2	6-10	Slight	12	B	IIw	Meadow hayland and pasture	Meadow grass
H6	6-10	Slight	10	B	IVw VIw	Range and meadow	Rabbitbrush, giant wildrye, salt-grass
L1	6-25	Moderate	1.5	D	VIIs	Range and watershed	Low sage-grass, pinyon-juniper-grass
L2	10-20	Moderate	1.5	D	VIIs	Range and watershed	Low sage-grass
L3	12-18	Moderate	1.5	D	VIIs	Range	Low sage-grass
L5	6-15	Severe	1.5	D	VIIs	Range and woodland	Big sage-grass, pinyon-juniper-grass
L6	8-18	Severe	1.5	D	VIIs	Range	Big sage-grass, pinyon-juniper-grass
L11	8-12	Moderate	1.5	D	VIIs	Range and watershed	Big sage-grass
L12	8-15	Slight	1.5	D	VIIs	Range and watershed	Big sage-grass, low sage-grass
R1	6-15	Moderate	6	C	VIIe	Range and watershed	Big sage-grass, bitterbrush, pinyon-juniper-grass

Continued

R5	8-15	Moderate	6	C	VIIe	Range	Big sage-grass
R6	8-12	Moderate	6	C	VIIe	Range and watershed	Big sage-bitterbrush, grass
R7	10-15	Moderate	6	C	VIIe	Range and watershed	Big sage-bitterbrush, grass
R9	8-18	Moderate	4	C	VIIe	Range	Big sage-grass
R11	8-25	Moderate	7	C	VIIe	Range	Big sage-grass, pinyon-juniper-grass
R12	6-15	Severe	4	C	VIIe	Range	Big sage-grass
R13	10-18	Severe	4	C	VIIe	Range	Big sage-grass, mixed browse
S2	6-10	Moderate	3	D	VIIs	Range	Shadscale-budsage-grass
S3	10-12	Moderate	4	C	VIIe	Range	Big sage-grass, spiny hopsage
S4	8-12	Moderate	6	C	VIc VIIe	Range, nonstony areas seedable	Big sage-grass
S5	6-12	Moderate	4	C	VIc VIIc	Range, small areas seedable	Big sage-grass
S6	6-12	Moderate	4	D	VIIs	Range	Shadscale-budsage
S7	8-12	Moderate	5	C	VIc	Range	Big sage-grass, spiny hopsage
S8	8-12	Slight	4	D	VIIe	Range	Big sage-grass
S9	8-10	Slight	6	D	VIc VIIe	Range, 30% seedable	Big sage-grass
S10	8-10	Moderate	7	C	VIc	Range	Big sage-grass
S12	8-12	Severe	6	C	VIIe	Range	Big sage-grass
S15	6-10	Moderate	8	B	VIc VIIc	Range	Big sage-grass
W1	6-10	Moderate	5	D	VIIs	Range	Greasewood-saltgrass
Y1	6-10	Slight	12	D	IVw VIIs	Range, small amounts cropland	Greasewood-saltgrass
Z	Rockland	-----	--	-	----	-----	-----

1/ Available water holding capacity.

Source: Humboldt River Basin Field Party.

HYDROLOGIC SOIL GROUPS

Watershed soil determinations are used in the preparation of hydrologic soil cover complexes, which in turn are used in estimating direct runoff. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling and without the protective effects of vegetation.

Group A - Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well to excessively well drained sand or gravel. These soils have a high rate of water transmission and would result in a low runoff potential.

Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture and slow infiltration rate. These soils have a slow rate of water transmission.

Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with a claypan or clay layer at or near the surface; and (4) shallow soils having a very slow rate of water transmission.

LAND USE CAPABILITY CLASSES AND SUBCLASSES

The capability classification is a practical grouping of soils. Soils and climate are considered together as they influence use, management, and production on the farm or ranch.

The classification contains two general divisions: (1) land suited for cultivation and other uses; and (2) land limited in use and generally not suited for cultivation. Each of these broad divisions has four classes which are shown by a number. The hazards and limitations in use increase as the class number increases. Class 1 has few hazards or limitations, or none, whereas Class VIII has a great many.

Capability classes are divided into subclasses. These show the principal kinds of conservation problems involved. The subclasses are "e" for erosion, "w" for wetness, "s" for soil, and "c" for climate.

Capability classes and subclasses, in turn, may be divided into capability units. A capability unit contains soils that are nearly alike in plant growth and in management needs.

Land Suited for Cultivation and Other Uses

Class I — Soils in Class I have few or no limitations or hazards. They may be used safely for cultivated crops, pasture, range, woodland or wildlife.

Class II — Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

Class III — Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

Class IV — Soils in Class IV have greater limitations and hazards

Land Suited for Range and Other Uses

Class V — Soils in Class V have little or no erosion hazard but have other limitations that prevent normal tillage for cultivated crops. They are suited to pasture, woodland, range or wildlife.

Class VI — Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland, or wildlife.

Class VII — Soils in Class VII have very severe limitations or hazards that make them generally unsuited for cultivation. They

are suited to grazing, woodland, or wildlife.

Class VIII Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range, or woodland. They may be used for recreation, wildlife, or water supply.

ANNUAL WATER BALANCE STUDY - 80% FREQUENCY (CHANCE)

Annual water balance, as used in these studies, is the evaluation of a portion of the hydrologic cycle. The cycle starts with incident precipitation on the watershed, and ends with the runoff, both surface and subsurface flow, after subtracting water uses and losses.

The annual water balance was calculated for an 80 percent frequency (expected to be equaled or exceeded eight out of 10 years). This frequency was used because normally such a water supply would be the quantity needed to justify land and irrigation improvements on ranches growing high-yielding crops.

Values obtained using this procedure are approximations. Accuracy would depend on the reliability of the basic soils, vegetation, and hydrologic data used, and would normally be in the range of 60 to 90 percent.

Water yield data are not available on the watersheds in Reese River Sub-Basin, except in the southern extremity of Reese River (Ione Gage), above the Indian Creek confluence. U.S. Geological Survey streamflow records for 12 years at this gage on Reese River, along with some partial records on Reese River at the Berlin Gage, above the Illinois Creek confluence, were used to estimate the 80 percent yield.

Upper Reese Watershed, which is gaged above all irrigation diversions, was used as a trial watershed for developing water balance data in the southern Toiyabe Mountains. The U.S. Geological Survey's stream flow records for this gage indicate that normally over 75 percent of the annual flow occurs during April, May, and June, with the greatest average flow in May. Discharge extremes, measured from 1913 to 1916, and from 1952 to 1963, vary from no flow at times in some years to a calculated 512 c.f.s. on July 27, 1956. The annual flow extremes vary from 1,700 acre-feet in 1960 to about 20,000 acre-feet in 1958.

The available information used for determining precipitation in the watershed area consisted of recording stations as listed under Precipitation in this report. In addition, there are five cooperative snow survey courses, three on Big Creek and two on upper Reese (Upper and Lower Corral). The short period of record available for the storage gages was extended by comparing this data with the same period of record at Austin; the rate for the 80 percent frequency and average annual precipitation was extrapolated from these curves. The results of this procedure suggest that the present indicated average annual precipitation would increase slightly for these stations if a longer period of record were available.

These data gave an indication of the annual precipitation. The precipitation used in the water balance studies was determined as the quantity needed to produce the 80 percent frequency flow, after subtracting the water uses and losses.

Calculations for the water balance in this sub-basin included the following assumptions:

1. The hot springs in middle Reese River and in Crescent Valley originate within the sub-basin.

2. The flow from cold springs is part of the gross water yield (estimated available water prior to agricultural and phreatophytic uses).

A flow diagram of water yields and depletions, with quantities in acre-feet, is shown in figure 1. Table 8 is a summary of the water balance studies by elevation zones for watersheds. The difference in water yield, inches per acre, is caused by the difference in watershed characteristics. These characteristics include (1) precipitation; (2) exposure; (3) soil development; (4) condition and species of plant cover; and (5) the physical features of the drainage.

During an 80 percent frequency year there is more water used and lost in the Crescent-Carico Lake Valleys and in Big Creek, Middle Reese, and Lower Reese watersheds than is available from gross water yield (see watershed map, figure 3). The difference between the water used and lost and the water yield would indicate a use from ground water storage. As stated in this report under Water Use, it was assumed that the ground water storage basin remains in balance over a cycle of wet and dry years. The studies made by the Field Party seem to indicate that the water supply and the water used and lost may be in balance during a 30 or 40 percent frequency year (expected to be equaled or exceeded three or four years out of 10) in these drainages. The excess water from higher-yielding years would recharge the ground storage.

The outflow from Antelope Valley of 6,000 acre-feet annually, as reported by the U.S. Geological Survey - Ground Water Resources - Reconnaissance Series Report 19, and as shown in these studies, comes from ground water storage.

The annual water balance inventories by watershed were made to find answers to the following questions:

1. What is the gross water yield of the watersheds in the sub-basin? Gross water yield, for the purpose of this study, is the estimated available water, both surface and sub-surface, prior to agricultural and phreatophytic use. Generally, this water yield is estimated for a stream or streams at a point above the highest diversion for the main body of irrigated land on a flood plain of a valley.

2. What is the magnitude of water use and loss by each of the major ground cover types?

3. Where are the water-yielding areas in the sub-basin and in each watershed?

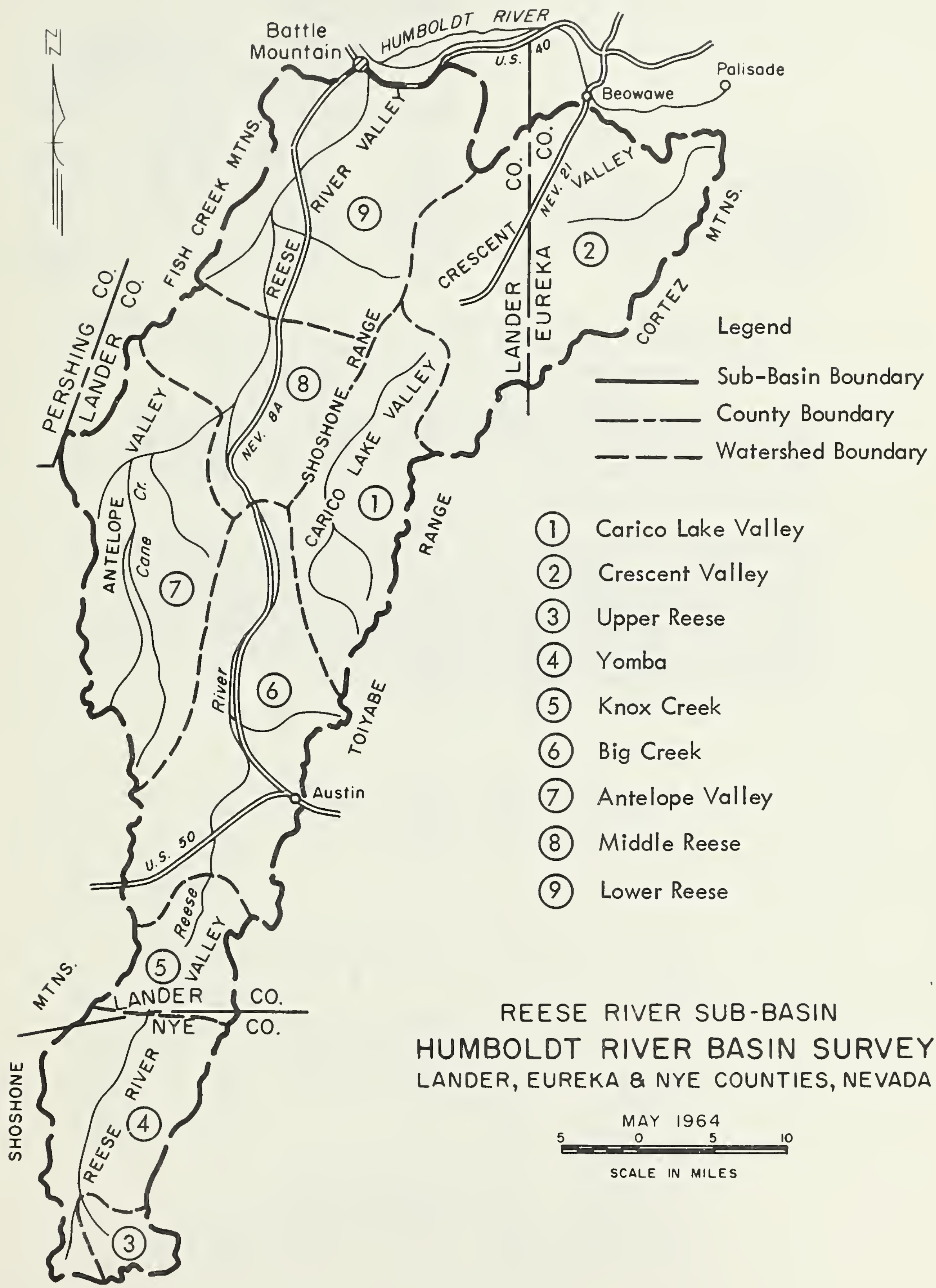
4. Can vegetal manipulation be used to increase water supply for beneficial use?

The sub-basin was divided into nine watersheds, in order to obtain a more accurate estimate of water yield, uses and losses. They are: (1) Carico Lake Valley; (2) Crescent Valley; (3) Upper Reese; (4) Yomba; (5) Knox Creek; (6) Big Creek; (7) Antelope Valley; (8) Middle Reese; and (9) Lower Reese (see watershed map, figure 3).

The results of the water balance studies indicated the following:

1. The 80 percent gross water yield (surface and subsurface) from the sub-basin was estimated to be 6,000 acre-feet from Crescent-Carico Lake Valleys, and 26,300 acre-feet from the Reese River drainage.

Figure 3.--Watersheds delineated for Water Balance Studies.



2. The estimated surface and ground water uses and losses are as follows:

	Crescent-Carico Lake Valleys		Reese River	
	Acres	Water use acre-feet	Acres	Water use acre-feet
Irrigated crops	1,400	1,800	18,500	19,800
Phreatophytes	45,900	16,200	69,600	25,900
Evaporation from semi-playas	2,200	1,100	------	------
Discharge to Humboldt River	------	------	------	------
Total 1/		19,100		45,700

1/ An estimated 13,100 acre-feet from Crescent-Carico Lake Valleys, and 19,400 acre-feet from Reese River Valley, is water used in excess of the water yield from ground water storage.

3. The drainages from the Toiyabe Range contribute about 60 percent of the water yield to Reese River and about 75 percent of the water yield to Carico Lake Valley. The Cortez Mountains contribute about 75 percent of the water yield in Crescent Valley.

4. Phreatophytes of low economic value, consisting of willow, wild rose, greasewood, rabbitbrush, saltgrass, and seepweed, use an estimated 19,600 acre-feet of water out of Reese River drainage and 11,300 acre-feet of water out of Crescent-Carico Lake Valleys. A large part of this water could be put to beneficial use by controlling some of these water-wasting plants.

Table 8. -- Summary of Water Balance Studies by elevation zones for watersheds in Reese River Sub-Basin for an 80% frequency

Elevation zone (feet)	Upper Reese River Acres	Upper Reese River Water Yield in./ac.	Upper Reese River Water Yield acre-feet	Yomba	Yomba Acres	Yomba Water Yield in./ac.	Yomba Water Yield acre-feet	Knox Creek	Knox Creek Acres	Knox Creek Water Yield in./ac.	Knox Creek Water Yield acre-feet
10,000+	4,200	3.37	1,180		3,100	2.05	530		600	6.00	300
9-10,000	8,700	1.71	1,240		15,300	1.18	1,500		4,300	3.43	1,230
8- 9,000	14,800	.90	1,110		51,000	.56	2,400		10,400	1.58	1,370
7- 8,000	7,300	.28	170		80,700	.08	540		13,300	.44	490
6- 7,000	-----	----	-----		67,900	----	-170		41,300	----	10
5- 6,000	-----	----	-----		-----	----	-----		20,100	----	-----
Total	35,000		3,700		218,000		4,800		90,000		3,400
Gross Water Yield:			3,700				4,800				3,400
Inflow:			-----	Upper Reese			3,700	Yomba			4,600
Use:											
Phreatophytes			-----			(2,000 ac.)	-1,500			(2,600 ac.)	-1,100
Irrigated cropland			-----			(2,400 ac.)	-2,400			(300 ac.)	- 200
Outflow: To Yomba			3,700	To Knox Creek			4,600	To Big Creek			6,700
Ground water storage change:			-----				-----				-----

Continued

Table 8. -- Summary of Water Balance Studies by elevation zones for watersheds in Reese River Sub-Basin for an 80% frequency -- Continued

Elevation zone (feet)	Big Creek Acres	Big Creek Water Yield in./ac.	Big Creek Water Yield acre-feet	Antelope Valley Acres	Antelope Valley Water Yield in./ac.	Antelope Valley Water Yield acre-feet	Middle Reese River Acres	Middle Reese River Water Yield in./ac.	Middle Reese River Water Yield acre-feet
10,000+	700	6.00	350	-----	----	-----	-----	----	-----
9-10,000	2,900	3.31	800	-----	----	-----	-----	----	-----
8- 9,000	10,200	2.16	1,840	1,000	2.04	170	500	.96	40
7- 8,000	43,200	1.02	3,670	14,700	.82	1,010	8,900	.63	470
6- 7,000	154,600	.09	1,170	92,900	.17	1,370	43,200	.13	480
5- 6,000	202,400	----	-130	149,500	.01	150	86,700	.02	140
4- 5,000	-------	----	-----	41,900	----	-----	61,700	----	-30
Total	414,000		7,700	300,000		2,700	201,000		1,100
Gross Water Yield:			7,700			2,700			1,100
Inflow: Knox Creek			6,700			-----	Antelope Valley		6,000
Use:									
Phreatophytes	(22,300 ac.)		-8,400	(1,000 ac.)		-300	(5,000 ac.)		-1,500
Irrigated cropland	(8,900 ac.)		-7,900	(1,300 ac.)		-1,900	(3,800 ac.)		-5,900
Outflow:			-----	To Middle Reese River		6,000	To Lower Reese River		4,600
Ground water storage change			-1,900			-5,500			-4,900

Continued

Table 8. -- Summary of Water Balance Studies by elevation zones for watersheds in Reese River Sub-Basin for an 80% frequency -- Continued

Elevation zone (feet)	Lower Reese River			Carico Lake Valley			Crescent Valley		
		Water Yield			Water Yield			Water Yield	
	Acres	in./ac.	acre-feet	Acres	in./ac.	acre-feet	Acres	in./ac.	acre-feet
9-10,000	300	2.40	60	300	2.80	70	-----	----	-----
8- 9,000	6,400	1.59	850	2,700	2.00	450	3,000	1.88	470
7- 8,000	11,400	.75	1,300	22,000	.83	1,520	31,400	1.04	2,720
6- 7,000	50,400	.12	510	70,200	.11	640	92,200	.16	1,250
5- 6,000	87,900	.02	180	152,800	----	-480	167,300	----	-320
4- 5,000	190,600	----	-----	-------	----	-----	168,100	----	-320
Total	357,000		2,900	248,000		2,200	462,000		3,800
Gross Water Yield:			2,900			2,200			3,800
Inflow: Middle Reese			4,600			-----			-----
Use:									
Phreatophytes		(36,700 ac.)	-13,100		6,900 ac.)	-2,100		(39,000 ac.)	-14,100
Irrigated cropland		(1,800 ac.)	- 1,500		(500 ac.)	- 700		(900 ac.)	- 1,100
Semi-playa			-----		(600 ac.)	- 300		(1,600 ac.)	- 800
Outflow:			-----			-----			-----
Ground water storage change			- 7,100			- 900			-12,200

Source: Humboldt River Basin Field Party.

Note: For further information see Water Balance Studies, Appendix II.

RECREATION AND WILDLIFE

Table 9. -- Planned recreational site development, Fallon (Reese River) and Austin Ranger Districts, Toiyabe National Forest, within the Reese River Sub-Basin, 1961-2000

Site name	Ranger District	N.F.R.S. 1/ site number	Development schedule (fiscal year)	Type of development	Acres of development	F.U.'s 2/ planned (approx.)
Trading Post	Fallon	2	1961-1975	Camp	12	24
Cottonwood	Fallon	3	1976-2000	Camp	24	48
Forks	Fallon	4	1961-1965; 1971-1975	Camp	26	52
Paiute	Fallon	5	1961-1975	Camp	20	40
Trail	Fallon	6	1976-2000	Camp	26	52
San Juan	Fallon	7	1971-1975	Camp	18	36
Pinnacles	Fallon	8	1961-1975	Camp	30	60
Gateway	Fallon	9	1961-1975	Camp	8	16
Becker Canyon	Fallon	10	1966-1970	Camp	8	16
Marysville	Fallon	11	1976-2000	Camp	22	44
Beaver	Fallon	12	1961-1975	Camp	32	64
Mohawk	Fallon	13	1971-1975	Organization site	28	--
Ellsworth	Fallon	14	1971-1975	Camp	10	20
Shoshone	Fallon	15	1976-2000	Camp	8	16
Green Rock	Fallon	16	1961-1975	Camp	12	24
Ophir Summit	Fallon	17	1971-1975	Observation site, Ophir Road Summit	2	--
Hopi	Fallon	18	1966-1970; 1976-2000	Camp	24	48
Wildhorse	Fallon	19	1971-1975; 1976-2000	Camp	26	52
Stewart	Fallon	20	1976-2000	Camp	20	40

Continued

Table 9. -- Planned recreational site development, Fallon (Reese River) and Austin Ranger Districts, Toiyabe National Forest, within the Reese River Sub-Basin, 1961-2000 -- Continued

Site name	Ranger District	N.F.R.S. 1/ site number	Development schedule (fiscal year)	Type of development	Acres of development	F.U.'s 2/ planned (approx.)
Mahogany	Fallon	21	1976-2000	Camp	18	36
Columbine	Fallon	24	1961-1965	Camp	20	40
Lupine	Fallon	25	1976-2000	Camp	18	36
Summit	Fallon	26	1976-2000	Camp	34	68
Sentinel	Fallon	27	1960-1975	Camp	6	12
Palisades	Fallon	28	1976-2000	Camp	10	20
Bowl	Fallon	30	1966-1970	Camp	20	40
Stone Cabin	Fallon	31	1961-1975	Camp	20	40
Cow Canyon	Fallon	32	1966-1970	Camp	5	10
Paradise	Fallon	33	1961-1975	Camp	10	20
Veatches	Austin	6	1961-1975	Camp	13	26
First Canyon	Austin	8	1961-1975	Camp	5	10
North Fork	Austin	9	1961-1975	Camp	5	10
Big Creek Extension	Austin	10A	1966-1970	Camp	6	12
Corral Canyon	Austin	11	1966-1970	Organization site	8	--
Aspen Grove	Austin	12	1966-1970	Camp	6	12
Reed's Canyon	Austin	14	1961-1975	Camp	14	28

1/ National Forest Recreation Survey.

2/ Family Units, calculated at 2 units per acre.

Source: U.S. Forest Service, Toiyabe National Forest.

Table 10.-- Potential developments, recreation inventory report, 1961 and subsequent supplements, national land reserve, Reese River Sub-Basin

Site name and type of development	Acres	Site development cost (dols.)	Access roads: Miles	Access roads: Construction cost (dols.)	Access roads: Rights of way acquisition cost (dols.)	Access roads: Yearly maint. cost (dols.)	Trails: Miles	Trails: Devel. cost (dols.)	Water devel. cost (dols.)	Total devel. cost (dols.)	Area affected acres: BLM	Area affected acres: Other
Elko District												
Hot Springs Spa Camp (Crescent Valley)	1	700	4	1,000	400	60	--	---	3,000	5,100	80	80
Battle Mountain District												
Roadside area, Nevada Hy. 8A Crossing, Reese River (approx. 25 mi. N. of Austin)	1	---	-	-----	---	--	--	---	-----	-----	---	--
Lewis Canyon Camp; 5 camp units, 5 picnic units	20	15,000 (inc. water devel.)	-	-----	---	--	--	---	-----	15,000	20	--
Mill Creek Camp; 22 camp and picnic units	10	22,000 (inc. water devel.)	-	-----	---	--	--	---	-----	22,000	10	--
Trout Creek Camp 1/; (25 camp-picnic units, pond, access road, and simple sanitary facilities)	10 (approx.)	2,000 (annual maintenance cost)	-	-----	---	--	--	---	-----	No estimate	1,000	500
Iowa Creek Camp 1/; (35 camp-picnic units, with simple sanitary facilities)	15 (approx.)	1,000 (annual maintenance cost)	-	-----	---	--	--	---	-----	No estimate	100	400

1/ More primitive camp, to be used as dispersal areas for hunters, fishermen, etc.

Source: Bureau of Land Management, Battle Mountain District.

LIST OF SURVEYED WATERS, REESE RIVER SUB-BASIN WITH FISH-STOCKING SCHEDULE

The following tabulation lists all surveyed waters of the Reese River Sub-Basin, which include 23 streams and one reservoir. In Lander County there are considered to be 25.6 miles of fishable stream and 29.5 surface acres of fishable reservoir. In Nye County there are 36.1 miles of fishable stream.

County	Stream	Fishable length (miles)	Stocking schedule (pounds fish)
Lander	Big Creek	5.0	362
	Boone Creek	4.5	No allotment
	Hall Creek	None	No allotment
	Crum Creek	1.0	No allotment
	Fish Creek	None	No allotment
	Galena Creek	1.0	107
	Iowa Creek	None	No allotment
	Iowa Reservoir	29.5 (acres)	600
	Italian Creek	None	No allotment
	Lewis Creek	3.0	96
	Mill Creek	12.0	577
	Reeds Canyon Creek	None	No allotment
	Silver Creek	1.1	No allotment
Nye	Cottonwood Creek	1.2	47
	Crane Creek	None	No allotment
	Illinois Creek	None	No allotment
	Marysville Creek	2.0	No allotment
	Mohawk Creek	1.0	No allotment
	Reese River (below upper narrows)	10.6	729
	Reese River (upper)	13.0	Fingerling
	San Juan Creek	2.0	78
	Stewart Creek	3.0	162
	Tierney Creek	None	No allotment
	Washington Creek	None	No allotment
	Clear Creek	2.0	No allotment

Source: Nevada Fish and Game Commission.

FOREST SERVICE REGION FOUR
CHANNEL CONDITION CLASSIFICATION CRITERIA

The following describes a method of classifying the condition of perennial or intermittent stream channels. Channel condition, as used here, is measured by indicators of channel stability. Classification is not based on any one factor; all the criteria must be weighed before a decision is reached.

Class 1 - Good

1. Channel sides well vegetated.
2. No slumping of channel sides.
3. Very little or no cutting or deposition of channel bottom.
4. Aquatic vegetation on channel sides and bottom.
5. Algae on rocks.
6. Very little or no recent cutting or deposition along channel sides.

Class 2 - Fair

1. Channel sides partially vegetated.
2. Slumping of channel sides at constrictions and bends.
3. Some cutting of channel bottom at constrictions, bends and steep grades and deposition in areas where the water velocity is less, e.g. pools.
4. Aquatic vegetation scattered, mostly in areas where stream velocities are low.
5. Algae on rocks in places where the bottom is stable.
6. Some cutting of stream banks at constricted areas or at outside of bends; deposition at the inside of bends and at the confluence with other streams.

Class 3 - Poor

1. Very little vegetation on channel sides.
2. Slumping of channel sides common.
3. Cutting and deposition of channel bottom common, bottom obviously in a state of flux.
4. No aquatic vegetation.
5. No algae on rocks.
6. Large-scale cutting of stream banks common.

Channels in Rock

In some instances, the channel cross section may be carved in rock. In this case, some of the factors listed under the Fair or Poor class may be in evidence, e.g., lack of vegetation on banks and deposition at grade changes. In order to classify the condition of such channels on the basis of channel stability, they must be considered to be in the Good condition class.

AGRICULTURAL INDUSTRY TABLES

Table 11. -- Ranch characteristics, Lander County, Nevada, 1899-1959

	1959	1954	1949	1944	1939	1929	1919	1899
Farms	22	33	33	38	54	44	64	69
Land in farms (acres)	360,288	640,898	653,200	461,471	204,029	118,655	133,566	86,824
Average size of farms (acres)	16,377	19,421	19,794	12,144	3,778	2,697	2,087	1,258
Value of land & building								
average per farm, (dollars)	141,380	74,771	93,669	55,566	18,755	25,725	29,214	10,476
average per acre, (dollars)	37.09	31.70	2.98	4.88	4.96	9.54	13.90	8.33
Ownership of private land	22	33	33	38	54	44	64	69
Full owner, percent	64	64	70	60	65	75	82	73
Full owner, number	14	21	23	23	35	33	52	51
Part owner, percent	28	24	21	32	15	4	3	3
Part owner, number	6	8	7	12	8	2	2	2
Manager, percent	4	6	6	5	11	11	9	12
Manager, number	1	2	2	2	6	5	6	8
Tenant, percent	4	6	3	3	9	9	6	12
Tenant, number	1	2	1	1	5	4	4	8
Hired workers, number	97	119	92	92	126	-----	-----	-----
Farms by economic area	22	21	32	-----	-----	-----	-----	-----
Class I	5	7	8	-----	-----	-----	-----	-----
Class II	9	5	9	-----	-----	-----	-----	-----
Class III	2	7	8	-----	-----	-----	-----	-----
Class IV	6	-----	-----	-----	-----	-----	-----	-----
Class V	-----	2	7	-----	-----	-----	-----	-----
Class VI	-----	-----	-----	-----	-----	-----	-----	-----

Source: U.S. Census of Agriculture.

Table 12. -- Specified farm expenditures, Lander County, Nevada, 1939-59

Item	1959	1954	1949	1939
	Dollars	Dollars	Dollars	Dollars
Feed for livestock & poultry	202,912	93,377	50,650	8,201
Purchase of livestock	563,280	------	64,339	-----
Machine hire	2,100	1,255	27,023	11,544
Hired labor	219,780	245,508	182,742	88,854
Gas & other petroleum	106,353	43,721	27,592	11,287
Seeds and plants	3,245	------	4,108	-----
Fertilizer	-------	560	------	-----

Source: U.S. Census of Agriculture.

Table 13. -- Farm size in Lander County, Nevada, 1934-1959

	1959	1954	1949	1944	1939
All farms					
Number	22	33	33	38	54
Acres	360,288	640,898	653,200	461,671	204,058
Under 10 acres to 259 acres					
Number	2	5	5	4	18
Acres	130	452	634	748	2,177
260 to 499 acres					
Number	2	6	9	10	7
Acres	629	2,022	2,997	3,528	2,444
1,000 or more acres					
Number	14	16	14	16	19
Acres	357,168	634,435	646,257	451,683	192,529

Source: U.S. Census of Agriculture.

Table 14. -- Crop production, Lander County, Nevada, 1899-1959

	1959	1954	1948	1944	1939	1934	1929	1924	1919	1909	1899
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Wild hay	1,635	6,686	11,732	19,373	11,386	2,430	6,366	8,112	8,814	14,384	10,660
Clover-Tim. Mix	1,339	630	600	40	672	82	1,065	110	413	223	113
Accumulated total	2 974	7,316	12,332	19,413	12,058	2,512	7,431	8,222	9,227	14 607	10,773
Alfalfa	2,808	3,944	1,945	2,849	3,044	1,099	3,071	3,294	2,813	3,127	3,440
Accumulated total	5,782	11,260	14,277	22,262	15,102	3,611	10,502	11,516	12,040	17,734	14,213
Small grain cut for hay	30	15	545	------	23	-----	------	33	75	------	114
Accumulated total	5,812	11,275	14,822	22,262	15,125	3,611	10,502	11,549	12,115	17,734	14,327
Other hay cut	-----	673	655	-----	1,410	-----	90	33	137	3,440	230
Total land from which hay was cut	5,812	11,948	15,477	22,262	16,535	3,611	10,592	11,582	12,252	21,174	14,557
Small grains	-----	65	232	263	130	15	71	242	131	731	857
Miscellaneous crops	7	69	21	43	389	28	65	153	55	142	122
Total cropland harvested	5,819	12,082	15,730	22,568	17,054	3,654	10,728	11,977	12,438	22,047	15,536
Irrigated cropland harvested	5,819	11,262	15,641	22,568	17,054	3,654	10,728	11,977	10,400	22,047	------

Source: U.S. Census of Agriculture.

Table 15. -- Cattle and sheep on farms, Lander County, Nevada, 1899-1959

Year	Cattle and calves: Number	Cattle and calves: Animal units	Sheep and lambs: Number	Sheep and lambs: Animal units	Total AUM's
1959	21,403	17,122	11,524	2,305	19,427
1954	20,330	16,264	24,168	4,834	21,098
1949	20,401	16,321	29,291	5,858	22,179
1944	21,798	17,438	27,243	5,449	27,247
1939	11,424	9,139	25,873	5,175	14,314
1934	18,763	15,010	42,221	8,444	23,454
1929	11,815	9,452	65,621	13,124	22,576
1924	14,692	11,754	62,290	12,458	24,212
1919	13,161	10,520	62,547	12,509	22,938
1909	38,139	30,511	137,480	27,496	58,007
1899	18,219	14,575	56,924	11,385	25,960

Source: U.S. Census of Agriculture.

Table 16. -- Livestock sold alive and pounds of wool shorn, Lander County, Nevada, 1939-59

Year	Cattle & calves	Cattle	Calves	Sheep & lambs	Pounds of wool shorn
1959	7,757	6,883	861	10,757	95,214
1954	6,085	4,749	1,336	12,753	173,160
1949	6,210	5,056	1,154	17,071	193,514
1944	5,597	-----	-----	8,837	210,658
1939	8,168	8,081	87	10,848	173,331

Source: U.S. Census of Agriculture.

Table 17. -- Nevada calf and lamb crop, 1925-1963, (per thousand)

Year	Calf crop	Lamb crop	Year	Calf crop	Lamb crop
1925	57	78	1955	82	83
1930	63	80	1956	77	89
1935	65	73	1957	83	92
1940	79	85	1958	78	89
1945	81	75	1959	79	88
1950	76	86	1960	80	87
1951	79	87	1961	78	88
1952	73	81	1962	80	89
1953	89	82	1963	80	89
1954	76	88			

Source: USDA Statistical Reporting Service.

Table 18. -- Average Nevada prices, 1925-1962, cwt.

Year	Beef cattle (dollars)	Calves (dollars)	Sheep (dollars)	Lambs (dollars)	Wool (dollars)
1925	6.00	8.20	7.90	11.90	41.00
1930	7.60	10.20	4.85	7.10	19.70
1935	6.20	7.10	3.20	6.80	18.30
1940	7.30	8.50	3.35	7.70	27.00
1945	11.80	12.60	5.60	12.80	40.00
1950	23.10	26.50	10.50	24.70	59.60
1951	29.70	33.20	13.10	30.10	82.10
1952	24.40	27.20	10.20	24.50	56.20
1953	15.70	16.90	5.90	16.90	55.30
1954	15.10	17.80	5.40	17.40	56.10
1955	14.40	17.60	5.20	17.60	46.10
1956	13.50	16.90	4.70	18.10	43.70
1957	11.40	19.50	6.10	19.70	51.70
1958	20.90	26.80	7.00	20.63	40.30
1959	21.40	27.10	6.00	18.50	42.00
1960	18.90	22.60	5.10	16.80	41.80
1961	18.19	24.34	4.51	15.85	38.80
1962	19.15	26.10	5.04	17.92	46.50

Source: USDA Statistical Reporting Service.

APPENDIX II

This appendix is produced in a relatively limited number of copies. It contains material germane to the Reese River Sub-Basin but which, because of its detailed or technical nature, is not attached to copies for general distribution.

Such material, however, has potential value as an information reservoir for technicians, administrators, and resource managers concerned with the Reese River Sub-Basin.

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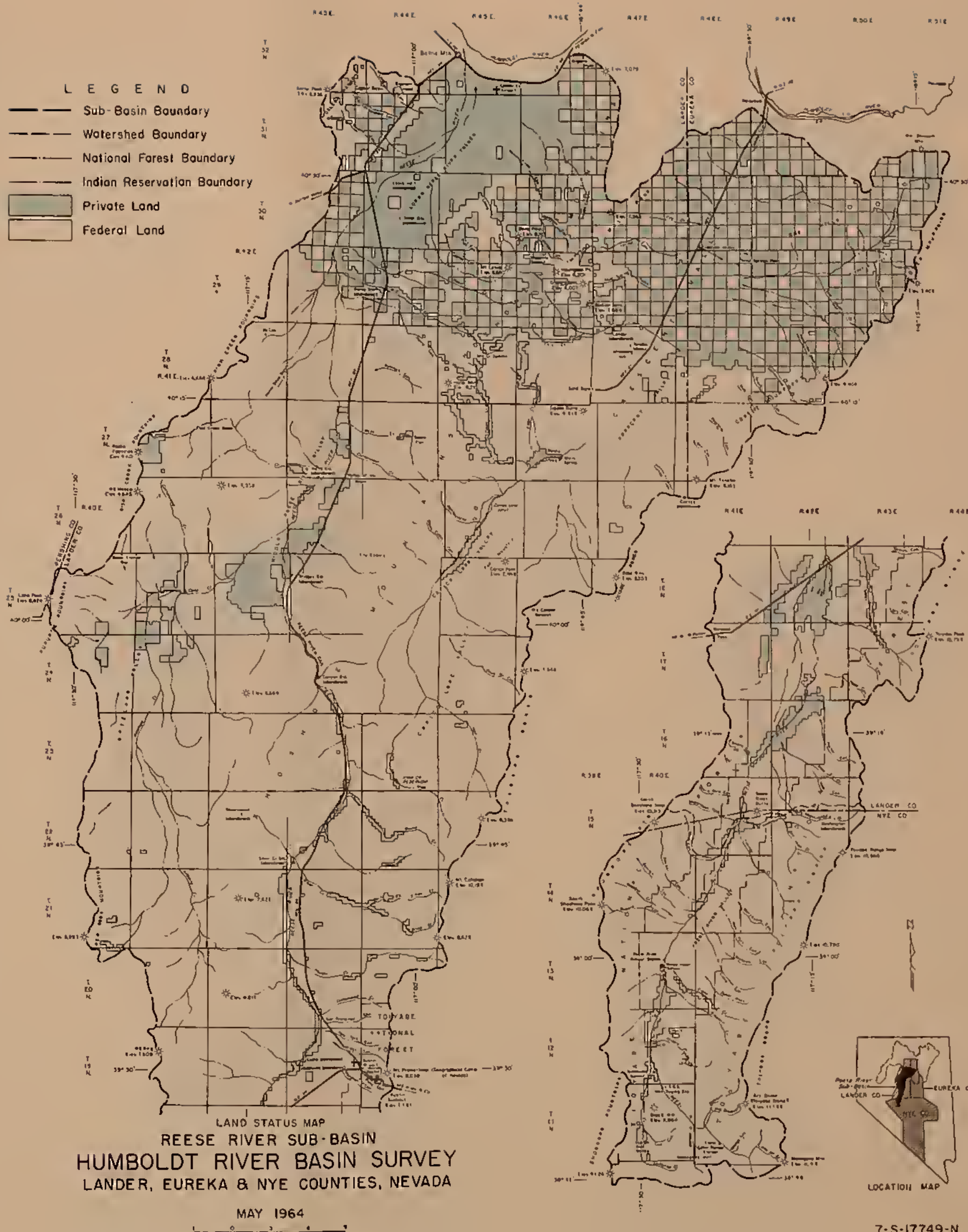
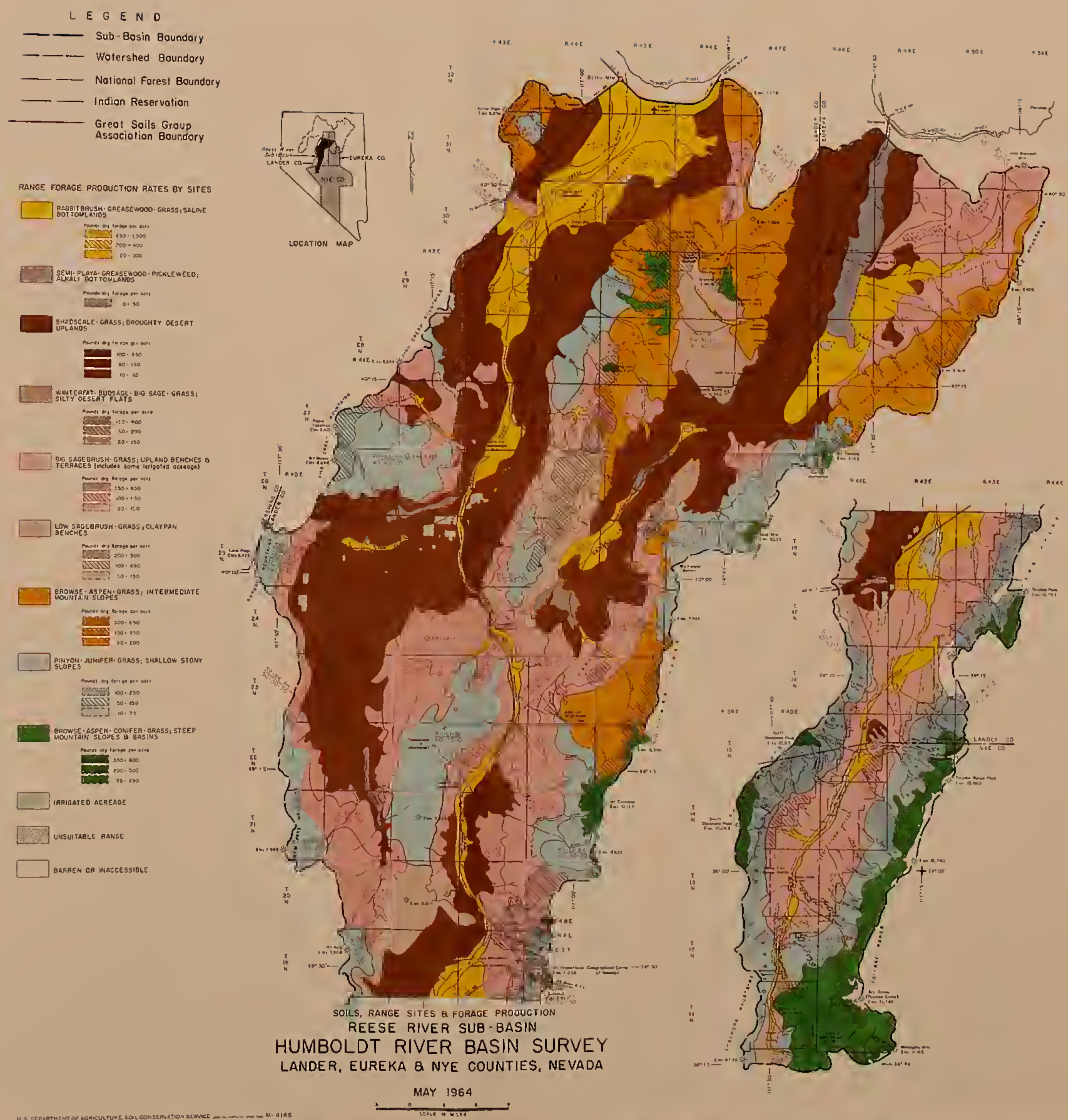


LAND STATUS MAP
REESE RIVER SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
LANDER, EUREKA & NYE COUNTIES, NEVADA

MAY 1964

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE M-4146


LEGEND
Sub-Basin Boundary
Watershed Boundary
National Forest Boundary
Indian Reservation
Great Soils Group Association Boundary
RANGE FORAGE PRODUCTION RATES BY SITES
RABBITBRUSH-GREASEWOOD-GRASS; SALINE BOTTOMLANDS
SEMI-PLAYA-GREASEWOOD-PICKLEWEED; ALKALI BOTTOMLANDS
SHADSCALE-GRASS; DROUGHTY DESERT UPLANDS
WINTERFAT-BUDSAGE-BIG SAGE-GRASS; SILTY DESERT FLATS
BIG SAGEBRUSH-GRASS; UPLAND BENCHES & TERRACES (includes some irrigated acreage)
LOW SAGEBRUSH-GRASS; CLAYPAN BENCHES
BROWSE-ASPEN-GRASS; INTERMEDIATE MOUNTAIN SLOPES
PINYON-JUNIPER-GRASS; SHALLOW STONY SLOPES
BROWSE-ASPEN-CONIFER-GRASS; STEEP MOUNTAIN SLOPES & BASINS
IRRIGATED ACREAGE
UNSUITABLE RANGE
BARREN OR INACCESSIBLE
LOCATION MAP
EUREKA CO
LANDER CO
NYE CO
LANDER CO
NYE CO
SOILS, RANGE SITES & FORAGE PRODUCTION
REESE RIVER SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
LANDER, EUREKA & NYE COUNTIES, NEVADA
MAY 1964
SCALE IN MILES
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
M-4146

TYPE 2 MEADOW

Dst Distichlis stricta (inland saltgrass)
Ecl Elymus cinereus (Great Basin wildrye)
CAR Carex spp (sedge)
Sai Sporobolus airoides (alkali sacaton)

TYPE 3 PERENNIAL FORBS

SUA Suaeda spp. (alkali seepweed)

TYPE 4 SAGEBRUSH

Art Artemisia tridentata (big sagebrush)
Cna Chrysothamnus nauseosus (rubber rabbitbrush)
Ars Artemisia spinescens (bud sagebrush)

TYPE 5 BROWSE - SHRUB

SAL Salix spp. (willow)

TYPE 13 SALTBUSH

Atc Atriplex confertifolia (shadscale saltbush)
Anu Atriplex nuttallii (Nuttals saltbush)

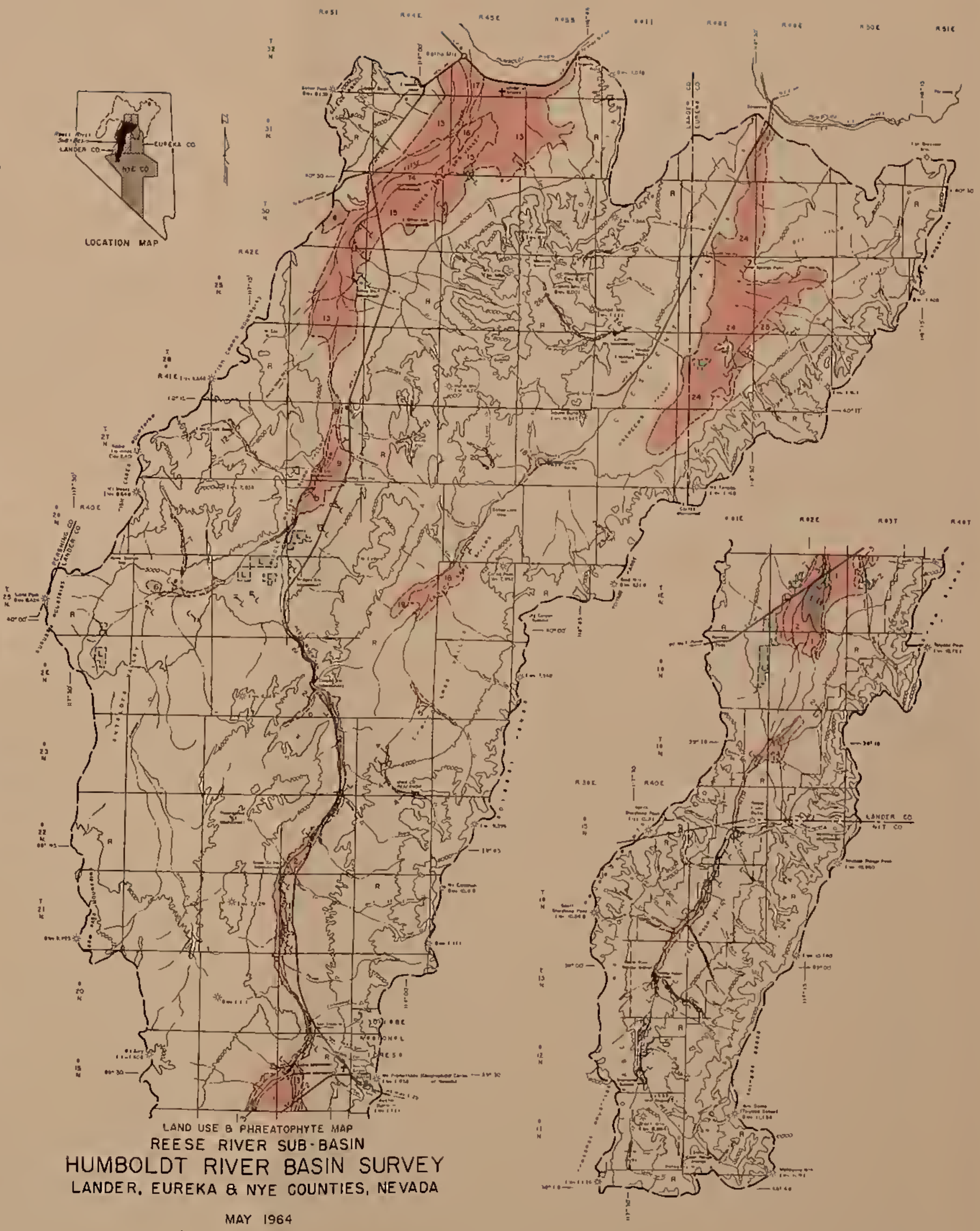
TYPE 14 GREASEWOOD

Sve Sarcobatus vermiculatus (black greasewood)

Type Number — Type Aspect — Abundant Species
14 - Sve - Cna - Ecl
07 30 10 10
Average Total Aspect Density — Percent of Species

1.	14-Sve-Cna-Ars-Ecl / 07-30-10-15-10	15	2-Sai-Ecl-Cna / 07-55-10-10
2	4-Cna-Sve-Dst / 08-40-20-15	16.	14-Sve-Dst-Sai-Cna / 08-25-25-25-10
3	2-Dst-Ecl-CAR-Sai / 12-40-10-10-10	17	14-Sve-Cna-Dst-SUA / 08-25-10-15-10
4	4-Cna-SAL-Ecl / 09-25-10-10	18	14-Sve-Cna-Dst / 04-40-35-10
5	14-Sve-Ars-Cna / 05-30-25-10	19	14-Sve-Art / 04-45-30
6	14-Sve-Atc-SUA / 05-35-30-15	20	4-Cna-Ecl-Art / 07-80-20-35
7	4-Cna-Sve-Atc-Ecl / 06-25-20-15-10	21.	4-Cna-Art-Dst-CAR / 08-50-15-10-10
8	14-Sve-Anu-Cna-Ecl / 04-35-25-20-5	22.	4-Cna-Art-CAR / 07-30-30-5
9	14-Sve-Atc-Ars / 06-35-10-10	23	4-Cna-Atc-SAL / 08-25-25-5
10	2-Ecl-SUA / 09-80-20	24	15-Sve-Dst-Sai-Ecl / 05-45-15-5-5
11	14-Sve-Cna-Art / 08-25-20-15	25	8-Cna-Sve-Dst-Sai / 06-30-10-25-20
12.	4-Cna-Art-Dst / 09-40-15-10	26.	4-Cna-Ecl-Sai-Dst / 06-30-15-10-5
13	14-Sve-Atc-Cna / 07-30-20-5	27.	4-Cna-CAR-Ecl / 08-30-10-5
14	14-Sve-SUA-Ecl / 06-25-25-10		

Sub-Basin Boundary
Watershed Boundary
Land Use Boundary
Elevation Contours in Feet
National Forest Boundary
Indian Reservation Boundary



Phreatophytes
Irrigated Hay or Pasture
Floodplain meadow
Range

LAND USE & PHREATOPHYTE MAP
REESE RIVER SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
LANDER, EUREKA & NYE COUNTIES, NEVADA

MAY 1964